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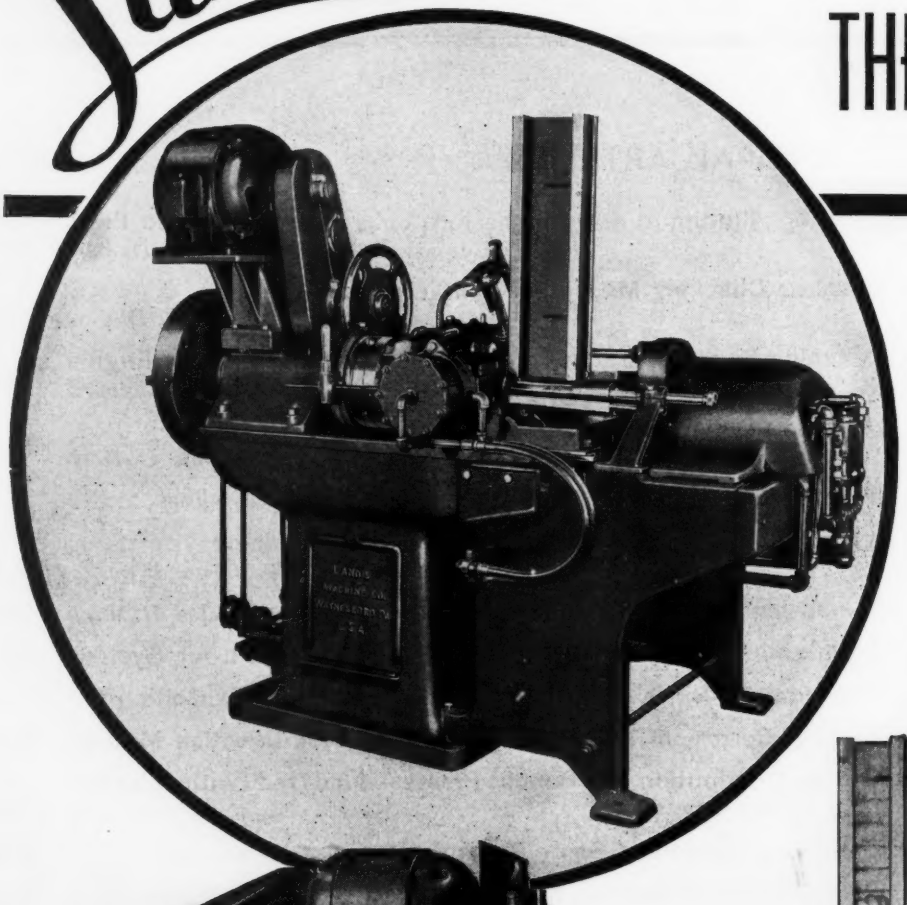

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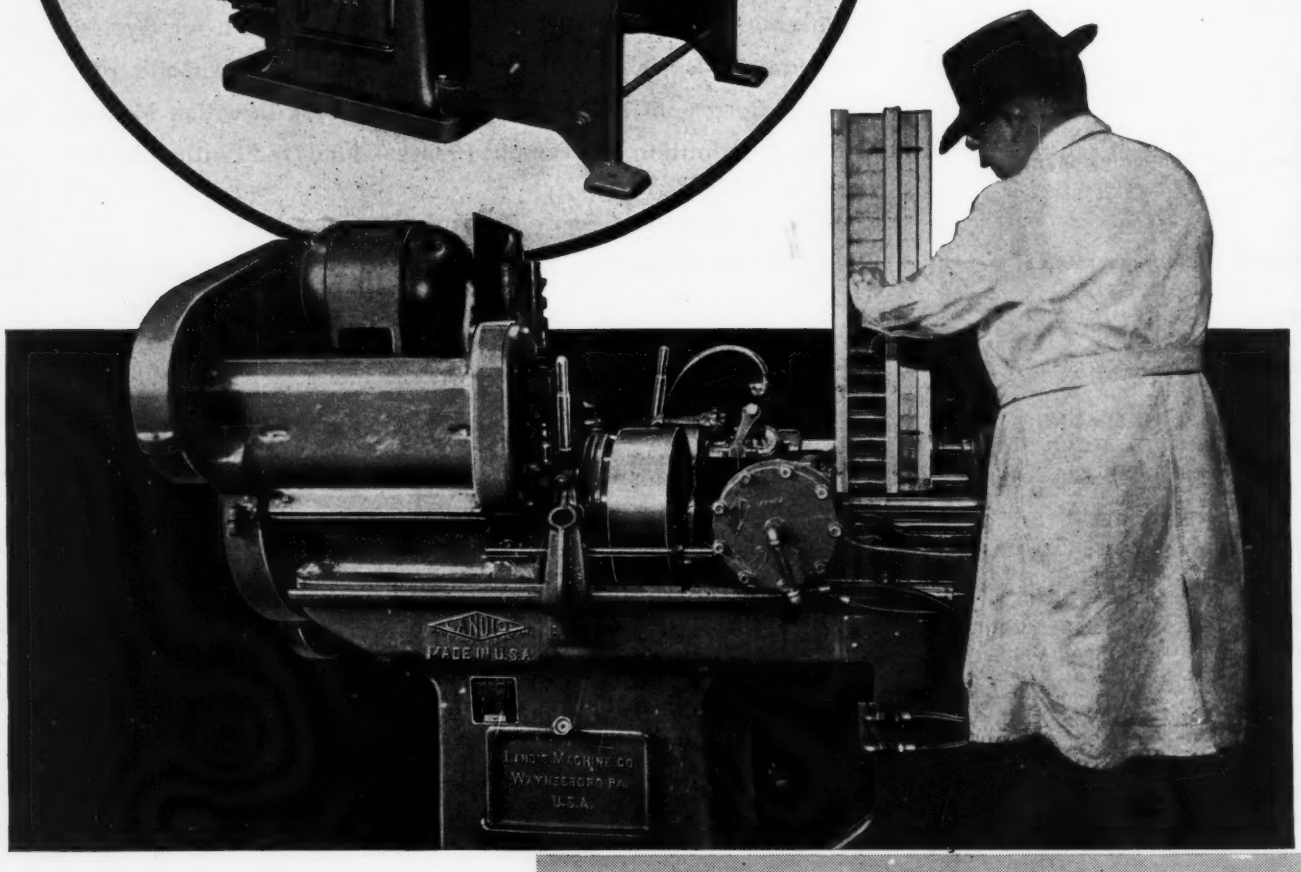

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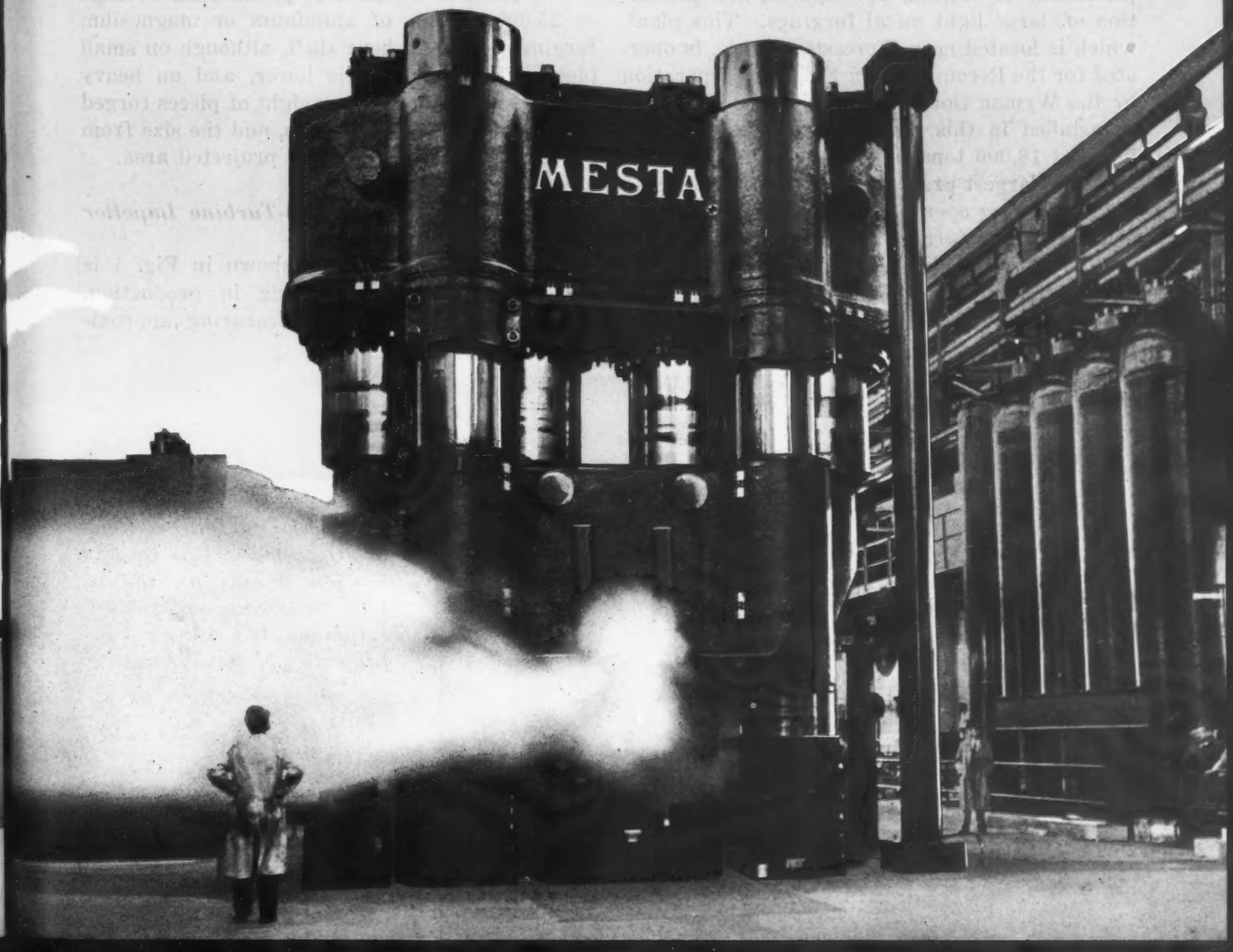
MACHINERY
Volume 54 OCTOBER, 1947 Number 2

Forging Aluminum and Magnesium on a Giant Hydraulic Press

By RALPH MOORE, General Superintendent and
J. R. DOUSLIN, Assistant General Superintendent
Wyman-Gordon Products Corporation
Worcester, Mass.

ALUMINUM and magnesium came out of the war with enhanced prestige and a widely increased field of applications, both actual and potential. Especially in the automotive and aviation industries, where low-weight, high-strength structures are desirable, have they supplemented heavier metals and plastics. However, to obtain large parts, such as frequently were required during the war, it was necessary either to cast them to shape or to machine them from large ingots. These methods resulted in physical properties considerably below the ultimate that could have been obtained by the die forging method.



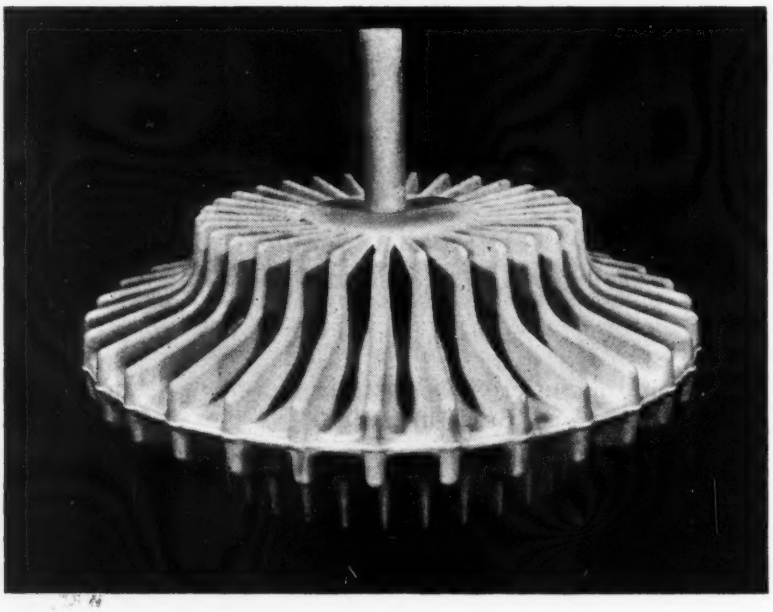


Fig. 1. This Gas-turbine Impeller Forging, Pressed from 25S Aluminum Stock, Weighs Approximately 460 Pounds and Contains Thirty-one Ribs on Each Side of the Center Line. The Ribs Taper to a Thickness of 1/2 Inch at the Outer Edge

As a result, the Reconstruction Finance Corporation, upon recommendation of the Air Forces and the War Production Board, authorized the construction of a plant devoted to experimentation in, and development and production of, large light metal forgings. This plant, which is located near Worcester, Mass., is operated for the Reconstruction Finance Corporation by the Wyman-Gordon Products Corporation.

Installed in this plant is a Mesta hydraulic press of 18,000 tons capacity, which is believed to be the largest press in the United States used for die forging operations. All auxiliary equipment, including furnaces and other heat-treating equipment, trimming presses, and laboratory facilities, are designed specifically to support this one producing unit, which is shown in the illustration on page 135. Its availability removes the size limitations which heretofore have existed in this country on forgings of magnesium and high-strength aluminum alloys.

The plant is designed to produce an average of 25,000 pounds of aluminum or magnesium forgings per eight-hour shift, although on small pieces the production is lower, and on heavy pieces much higher. The weight of pieces forged varies from 15 to 550 pounds, and the size from 200 to 1000 square inches of projected area.

Forging an Aluminum Gas-Turbine Impeller

The gas-turbine impeller shown in Fig. 1 is the largest aluminum forging in production, weighing 460 pounds and measuring approxi-

Fig. 2. Cross-forging a Cast Ingot prior to Die Pressing Operations. This Operation Breaks up the Cast Grain Structure and Improves the Physical Properties of the Product

mately 31 inches in diameter and 12 1/2 inches in height. This impeller, used in the Allison J-33 engine, compresses incoming air prior to its flow to the combustion chamber. Since it operates at high speeds, and therefore is subject to large centrifugal forces, it must possess excellent physical properties. With this end in view, each forging is subjected to extensive quality control tests.

Forging stock is procured in the form of cast billets approximately 15 by 15 by 21 1/2 inches. Extruded stock would be preferable, as the extruding operation breaks up the cast grain structure and improves the physical properties—elongation, yield strength, and ultimate strength—of the cast material. However, extruded stock is not available in a size large enough for this forging, and therefore cast billets have to be used. In order to obtain the required properties, the cast billets are pre-worked by a cross-forging operation before the usual die-forging procedure is begun.

A sample cast billet from each incoming lot is cross-forged and heat-treated in the same manner as the final product. Specimens are then cut from this stock and sent to the laboratory, where they are checked for tensile strength and where a complete chemical analysis is made.

If these and subsequent tests indicate that the metal does not come up to the specifications or if the surface contains irregularities that will adversely affect the quality of the final forging, the lot is rejected. If the metal meets requirements, the lot is, of course, released and the cast ingots are loaded into the heating furnace. The furnace capacity is rated at 4300 pounds of metal heated to forging temperature per hour.

There are three furnaces of this type, built by the R. S. Products Corporation, which have a combined capacity of 12,900 pounds of metal per hour. The furnaces are propane-gas fired, and have three zones of heat control, each automatically regulated; the hearths are 8 feet wide by 40 feet long. During operation, these furnaces may or may not be put on the line together, depending on the forging rate, the weight of the billet, and the prescribed forging temperature. If the forging rate is low, only one furnace may be necessary; if high, all three may be needed.

About eighty ingots constitute a load. Thus, if the forging rate is higher than ten forgings per hour, more than one furnace is required. According to a rule-of-thumb method of calculating furnace time, the ingot should be heated for one-half hour for each inch of thickness of the material. For the impeller ingot, which is 15 inches thick, a minimum of eight hours is required before it reaches a uniform temperature of 850 degrees F.

After being heated, the block is cross-forged in the successive steps shown in Fig. 3. The final step, as will be seen from the illustration, consists of forging the ends of the block to hexagonal shape and upsetting it to the desired height for blocking or rough forging. All the steps in this cycle are performed with one heat.

Prior to the next forging operation, a blocker die is mounted in the press to form the ingot to

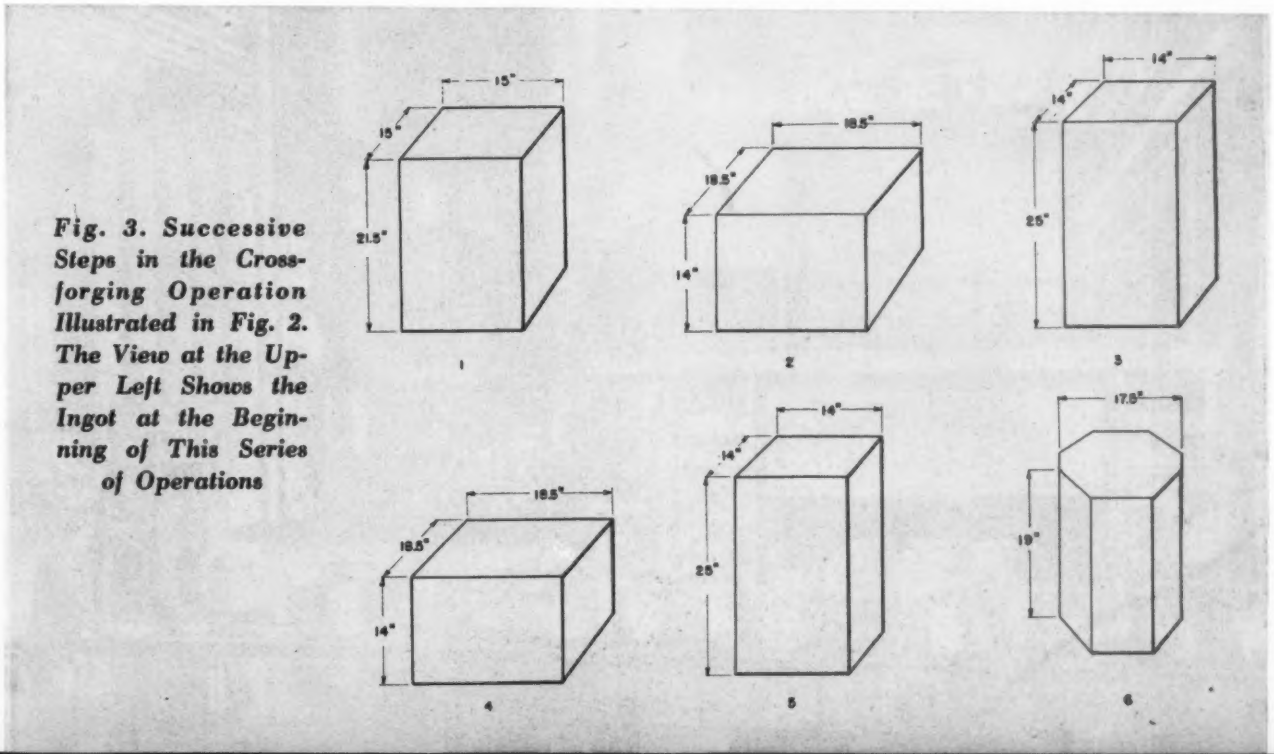


Fig. 3. Successive Steps in the Cross-forging Operation Illustrated in Fig. 2. The View at the Upper Left Shows the Ingot at the Beginning of This Series of Operations

a shallow cup shape from which the blocker forging can be pressed. The lower platen of the press is mounted on sliding ways so that it can be moved horizontally from under the cross-heads by a hydraulic cylinder, which is an integral part of the press. Both finish and blocker dies can then be removed or installed with an overhead crane.

The dies are aligned by a leader-pin die set similar to that used on conventional presses, except that it is, of course, much stronger, as it must stand the pull of the tremendous pressures exerted to counteract the play in the cross-heads. To prevent sticking in forging operations, a graphite and lead-base oil mixture is either brushed or sprayed on both blocker and finish dies prior to the forging operations.

The trimming die (Fig. 5) is of typical construction, with the cutting edge located on the stationary lower member mounted on a special fixture constructed as shown in the illustration.

The work is examined for surface defects after each forging operation, and if any are found, they are removed by grinding or chipping before the following operation is performed. After trimming, the piece is ready for final surface inspection. Preparation for this inspection consists of quenching in a 10 per cent caustic soda solution, maintained at 160 degrees F., for from three to five minutes. This is followed by a water rinse and a 10 per cent nitric acid bath that dissolves the copper oxide film caused by the alkaline solution.

The heat-treating cycle comes next. This consists of solution treating at 950 degrees F. for a minimum of three hours, quenching in water maintained at 180 degrees F., and aging at 320 degrees F. for ten hours. The heat-treating furnace is of the same general construction as the heating furnaces; it is of the pusher type, and has four automatically controlled temperature zones. The forgings are advanced side by side on roller racks into the furnace by a pushing mechanism. As the trays reach the discharge end, the furnace door opens and power-driven rollers carry them onto a small elevator. The furnace door then closes, and the elevator lowers the forgings into a water quench, where they remain for fifteen minutes before being raised and drained, as seen in Fig. 6. This phase of the heat-treating cycle is sequence-timed and fully automatic.

After aging at 320 degrees F., either in the forging or heat-treating furnaces for fourteen

Fig. 4. After the Pre-forming Operation, the Cast Ingots for the Gas-turbine Impeller Forging are Loaded into a Furnace where They are Heated for About Eight Hours Preliminary to Forging

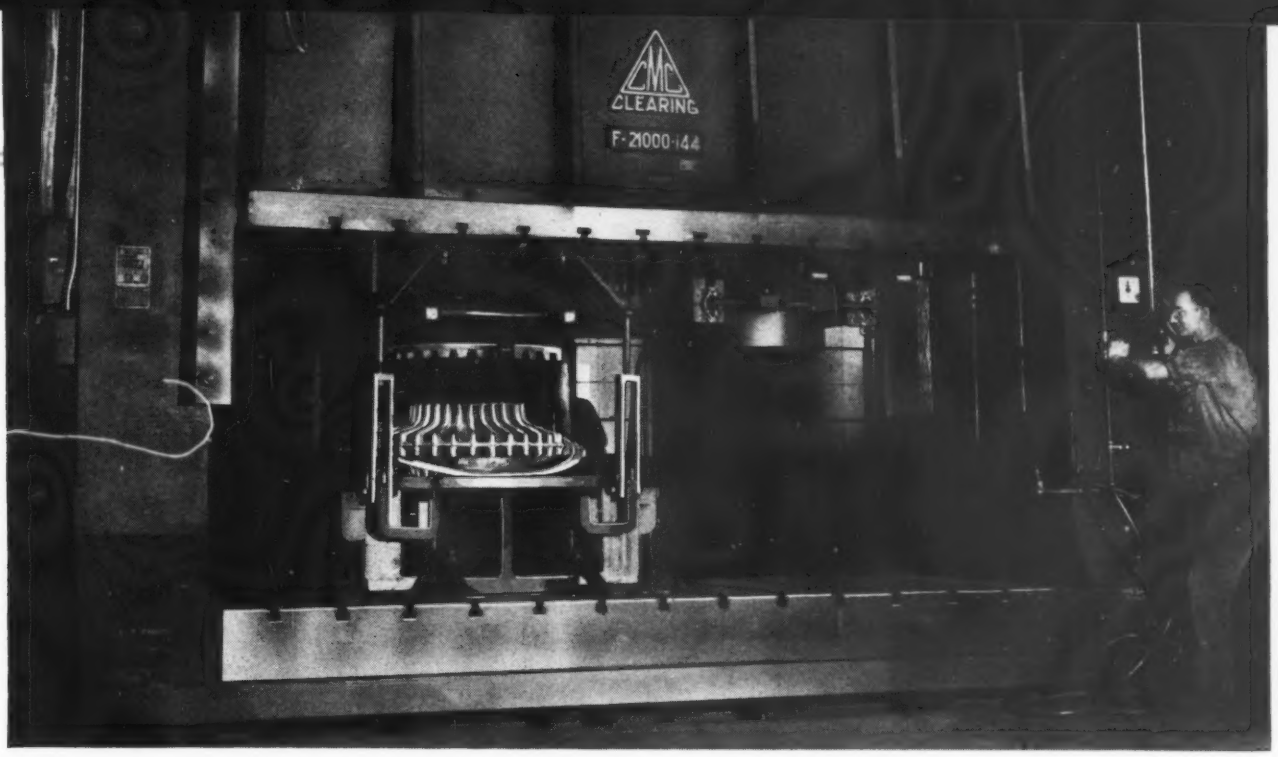


Fig. 5. The Trimming Die for the Aluminum Impeller Forging is of Typical Construction. The Trimming Press has a Capacity of 1000 Tons

hours (which gives ten hours at heat), the finished forging is ready for shipment. Along with each forging shipped goes a 2-inch round test piece which is formed integral with the forging and which is removed only after all processing is complete. Both the forging and the test piece carry a serial number through which the lot number, multiple number, forging and heat-treating dates, production crew, etc., can be traced. The test piece, coming from the same billet of material as the forging and having passed through all stages of processing with the forging, has the same physical characteristics, and, therefore, can be checked as a test specimen by the customer; one out of every five of these specimens is checked before leaving the plant.

As a double check on the physical properties, one impeller forging from each lot, regardless of the lot size, is cut up and tested at fifteen locations around the periphery, through the center, and at various points on different vanes. The forging must have a minimum yield strength of

Fig. 6. Forgings Coming out of the Heat-treating Furnace are Immediately Lowered into the Quenching Tank by a Sequence-timed Elevator. Fifteen Minutes is Required to Cool This Piece to 180 Degrees F.

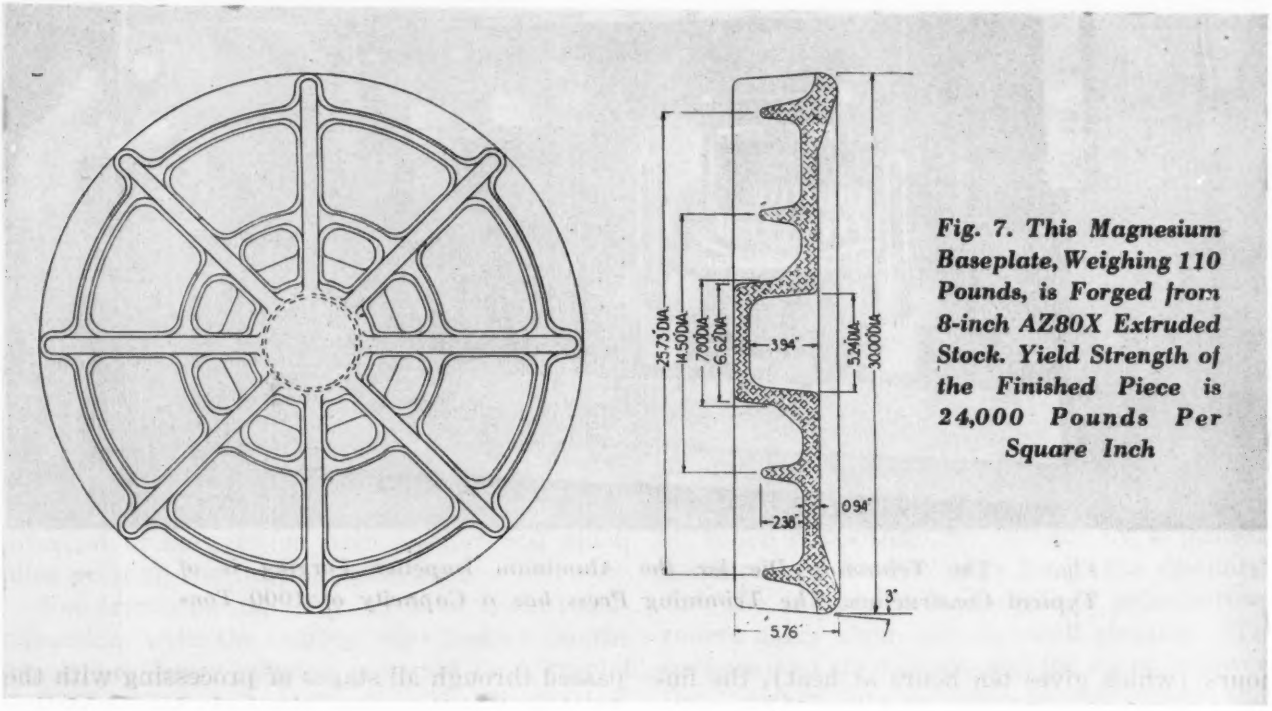


Fig. 7. This Magnesium Baseplate, Weighing 110 Pounds, is Forged from 8-inch AZ80X Extruded Stock. Yield Strength of the Finished Piece is 24,000 Pounds Per Square Inch

30,000 pounds per square inch, an ultimate strength of 45,000 pounds per square inch, and a minimum elongation of 5 per cent in 2 inches.

Requirements on the test pieces are even more severe. These are: 30,000 pounds per square inch yield strength; 55,000 pounds per square inch ultimate strength; and 10 per cent elongation in 2 inches. There are no critical dimensions that must be met, since the part is machined all over by the customer, but the weight is held within plus or minus 2 pounds.

Operations on Magnesium Forgings

Few modifications are necessary in the work cycle when forging magnesium. The main variations are in the forging and heat-treating temperatures, in the use of heated dies to forge the work, and in the addition of a pickling operation to protect the finished forgings from atmospheric attack.

The magnesium baseplate (Fig. 7) is forged from AZ80X round extruded stock; this is a magnesium alloy containing about 8 per cent aluminum and 1/2 per cent zinc. These bars are first cut to length on two Motch & Merryweather rotary saws equipped with automatic chip conveyors. Since good forging practice dictates that the stock have a maximum length of 2 1/2 times its diameter, and since the length of this bar exceeds that ratio, a special upsetting operation is required to prepare the stock for forging. This operation increases the diameter to 11 inches.

After being heated to 720 degrees F. for the rough-forging operation, the stock is put in the press, as shown in Fig. 8, and flattened to 5 inches in thickness. Because magnesium undergoes grain modification at 460 degrees F., the dies (both roughing and finishing) are heated to at least 500 degrees F. with a burner ring composed of a series of Selas gas heaters before starting the press. These are usually needed only in the pre-forging stages, since the stock tends to keep the dies hot in the operative states. Fig. 9 shows the burner ring around the die and an operator checking the temperature with a "Tempilstick," which melts when the die reaches the operating temperature.

The forging sequence is as follows: After the stock has been flattened, it is reheated to 720 degrees F. and blocked; it is then reheated and finish-forged. Heating for the upsetting operation requires approximately five and one-half hours, but subsequent operations on thinner sections take less than half that time. The dies for these operations are of standard design for this class of work.

Fig. 8. The Magnesium Billet Heated to a Forging Temperature of 720 Degrees F. is Put in the Press to be Flattened prior to Die Forging

Following the forging operations, the piece is trimmed and immediately quenched in water without further reheating. This is a form of solution heat-treatment. Since these alloys respond to high temperatures in the same manner as the heat-treatable aluminum alloys, subsequent heating is avoided to eliminate grain growth and deterioration in physical properties.

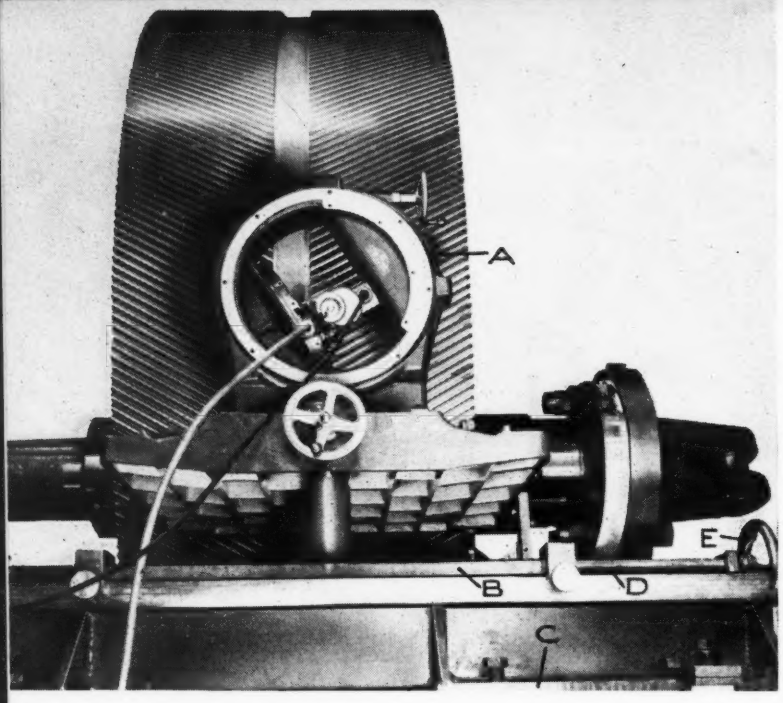
After being sand-blasted, the magnesium forgings are pickled in a solution consisting of 8 per cent nitric acid and 2 per cent sulphuric acid for from ten to fifteen seconds and rinsed in water. They are then inspected and ground, if necessary, following which they are aged at 325 degrees F. for sixteen hours.

All magnesium forgings are then given a chromium pickle protective treatment. The pickling bath contains sodium dichromate, nitric acid, magnesium sulphate, and water. This does not produce a permanent finish, but is intended to protect the surface until the piece is machined.

After a final inspection, the forgings are ready for shipment. On this magnesium baseplate, quality control methods do not require test pieces for each forging. Incoming material is checked according to standard practice before use, and one forging per lot is cut and tested for physical properties. Acceptance and production specifications are 24,000 pounds per square inch yield strength, 42,000 pounds per square inch ultimate strength, and a minimum elongation of 2 per cent in 2 inches.

The two forgings which have been referred to are typical of work that has been handled successfully in this plant. The ultimate capabilities of the press have not yet been completely determined. Recently, however, there have been proposed for consideration several parts which were designed specifically with this press in mind. It is expected that the forging of these parts will add substantially to the present knowledge of the production of large light metal forgings.

Fig. 9. Testing the Temperature of the Die with a "Tempilstick," which Melts when the Die Reaches the Desired Temperature. To Avoid Chilling the Stock, which Reduces its Workability, Magnesium Stock Must be Worked in Hot Dies



Involute Large

By D. W. DUDLEY
Gear Engineering Division
General Electric Co., Lynn, Mass.

THE load-carrying capacity and the quietness of operation of a pair of gears depend considerably on the accuracy with which the profiles of the teeth are made. While it is common practice to check the involute profile of small spur and helical gears by rolling the gears in a conventional involute checking machine having an indicator pointer that moves in a line tangent to the base circle, and at a linear velocity equal to the base circle, most marine gears and many types of industrial gears are too large to be checked in this manner. The biggest of these machines will handle only reasonably light-weight gears with a maximum diameter of approximately 24 inches and a maximum length, including the shaft, of about 3 feet.

In the past, it has been the custom of many manufacturers to check the profiles of pinions and gears by rolling the mating gears together in mesh and making contact markings with diemaker's blue and red lead or other substances. The profiles were judged satisfactory if they contacted properly. This did not guarantee that the designed involute was maintained, but that was not felt to be necessary, since it was known that the gears would function properly if the contact marking showed proper conjunction of the teeth.

However, with the trend toward much harder materials and heavier tooth loads in marine and industrial gears, many applications require greater accuracy than was obtained by this method. To meet this need, an entirely new machine was designed and developed for checking the involute of large helical gears. This machine uses a special checking head built by the Illinois Tool Works. The sub-base, main base, recording equipment, checking stand, and tools

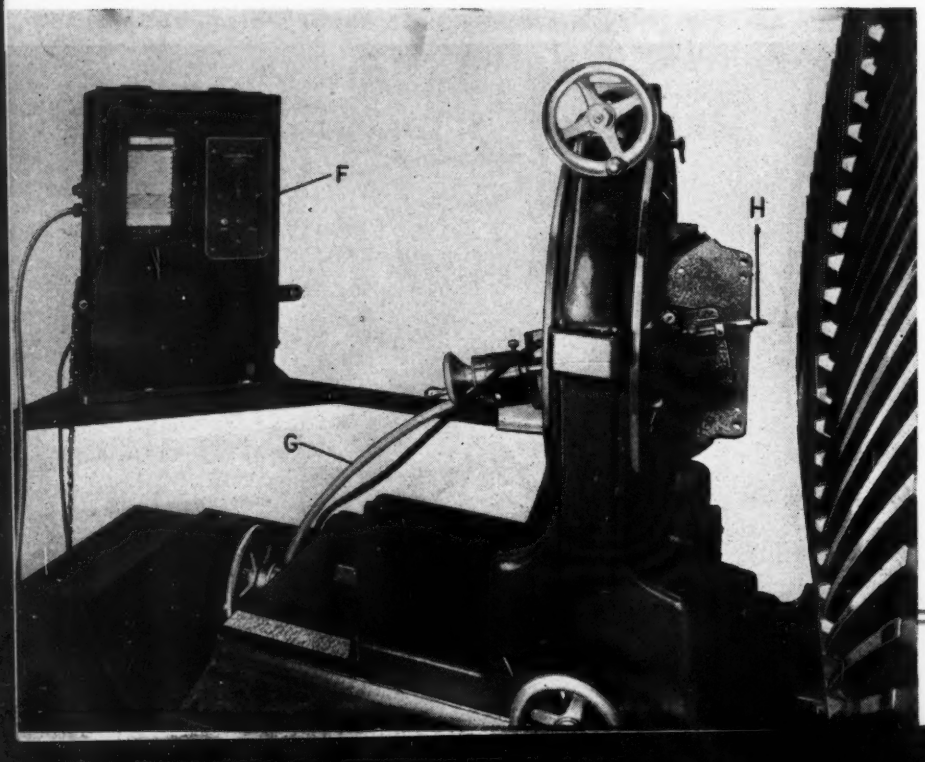


Fig. 1. (Top) Front View of Machine Designed for Checking the Involute of Large Helical Gears. The Checking Head A is Moved across the Tooth Profile and Transmits the Deviations from a Straight Line to a Recorder

Fig. 2. Side View of Checking Machine, Showing the Checking Finger H and the Recorder F

Checking Machine for Helical Gears

for setting up the machine were designed and built by the General Electric Co. It differs substantially in design from related machines in the small gear fields, but will check to the same degree of accuracy, and can be used either with or without recording equipment.

An idea of the construction of the checking machine will be obtained by referring to Fig. 1. The checking head *A* is mounted on a sub-base *B*, which can be moved axially along the main base *C* by a long screw *D*, geared to a motor in one end of the main base. The screw *D* can also be turned by the handwheel *E*.

The recording equipment is self-contained in a portable box *F*, as shown in Fig. 2. Linear motion of the checking finger is transmitted to the recorder by the flexible cable *G;* in this view, the checking finger *H* has been withdrawn from the gear teeth, so that it can be clearly seen.

In setting up work for inspection, the gear is placed in the checking stand, no particular alignment being required other than to have it in a fixed position. Then the checking machine is aligned in the exact position necessary to obtain an accurate check. In actual practice, the gear is lowered into V-blocks by a crane. The main base of the profiling machine is then aligned so that its guiding surfaces are parallel with the axis of the gear. Next, the checking head is squared with the gear axis, and the sub-base is tilted in relation to the radius of the gear, so as to bring the in-and-out travel of the contacting finger on a line through the center of the gear. The checking head is now moved in on the sub-base until the point of finger *H* comes in contact with the gear tooth on the pitch line. Finally, the helix angle and normal pressure angle settings are established.

While this procedure requires several operations, it is performed quite rapidly. The main base and the sub-base are provided with datum surfaces, leveling screws, and jacking screws to facilitate the set-up. Special tools such as standard height blocks and a leveling straightedge are also provided. Fig. 3 shows the set-up being made with a precision level which is laid across the gear journal and a standard height block on the checking head base. Little time is taken in checking the journals on each end of the gear for parallelism, since the motor-driven lead-screw drives the carriage rapidly from one end of the main base to the other.

The actual check of the gear profile is made in the normal section. This section was chosen

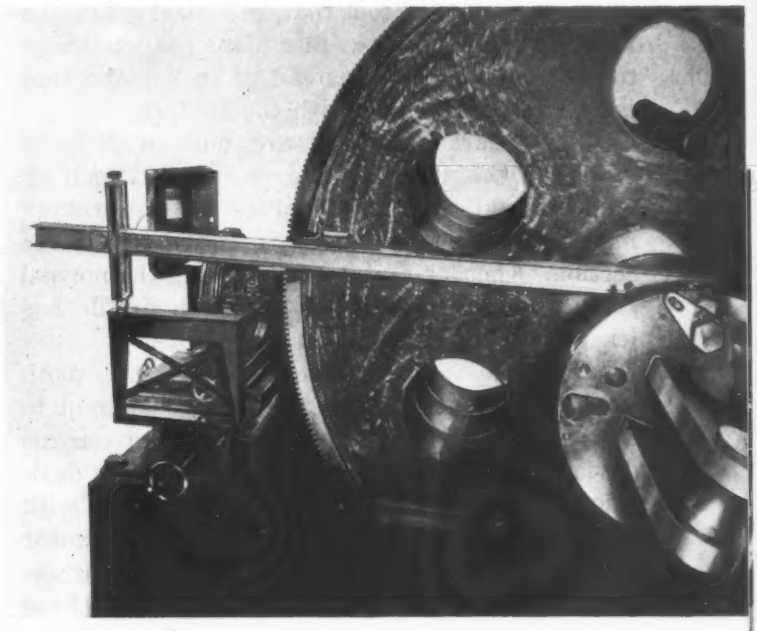


Fig. 3. Set-up of the Checking Machine is Facilitated by the Use of a Precision Level Laid across the Gear Journal and a Height Block on the Base of the Checking Head

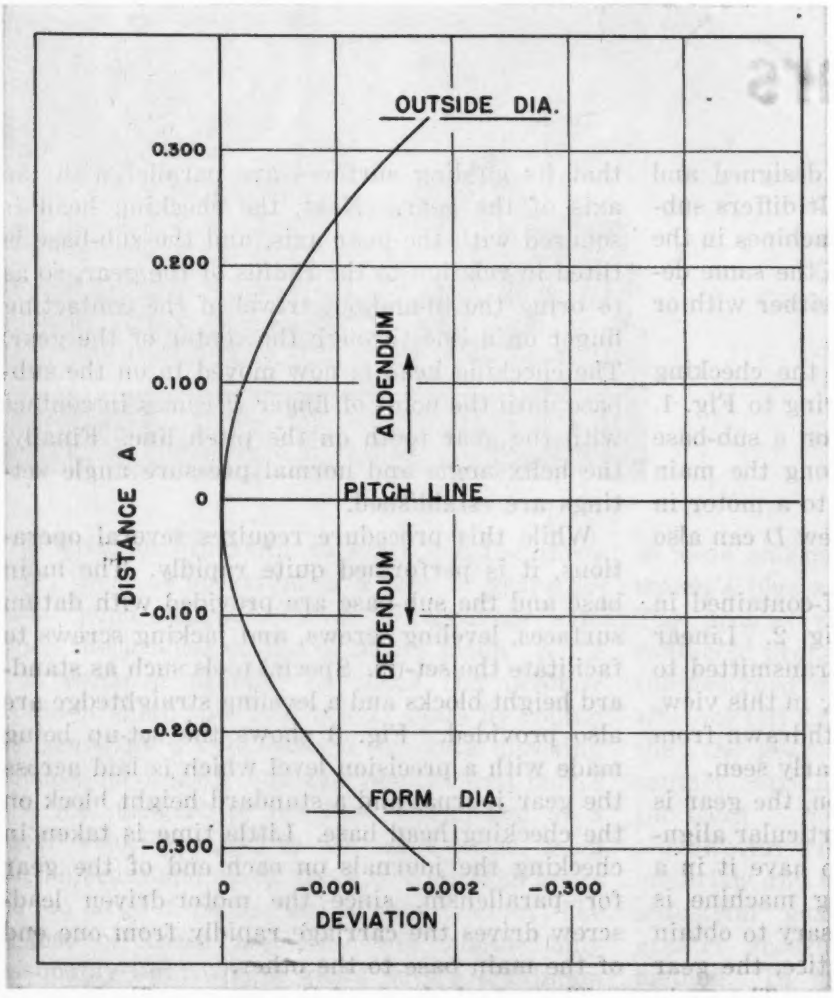


Fig. 4. The Deviation from a Straight Line of the True Involute Profile in the Normal Section of a Gear Must be Calculated before the Error in Tooth Contour can be Determined

instead of the more customary transverse section because of the fact that, in helical gears, the indicator pointer works in a plane perpendicular to the tooth surface instead of in a plane that is at an oblique angle with the surface.

Many gears for ships are built with helix angles in the 40- to 45-degree range. Such an angle would create difficulties in a checking machine constrained to work in the transverse section. Another reason for choosing the normal section was the fact that the tooth profile has less curvature in that section.

When the indicator moves across the tooth profile, it is guided in a straight line tangent to the profile at the pitch line. The indicator records deviations from a straight line rather than deviations from a true involute, as is the case with the small involute checkers. While the indicator is moving across the tooth profile, the gear remains motionless; it is not rolled on its base circle, as has been customary in making involute checks in the past.

To interpret the check data, it is necessary to have calculated the deviation from a straight line of the true involute profile in the normal section. The error in involute is the difference between the deviation of the tooth profile at a given point and the deviation of the true involute profile at that point. A method of calculating the deviation of any specified helical surface in the normal section has been published in the Transactions of the American Society of Mechanical Engineers.

The calculated normal section deviation of a large marine propulsion gear is shown in Fig. 4. The gear has an outside diameter of 143.389 inches and a face width of 37 1/4 inches. There are 403 teeth of 2.82258 diametral pitch, with a 30-degree helix angle. It may be surprising to find that the deviation values are so small for a

gear of this size. Actually, marine gears with large numbers of teeth and sizable helix angles are quite close to being straight-sided in the normal section. This was one of the reasons, in designing the machine, that it was decided to use a checking head that would record deviations from a straight line rather than to employ the more complicated method of rolling the gear and actuating the indicator in an involute motion.

A profile check recording of the gear for which the data charted in Fig. 4 was calculated is shown in Fig. 5. The check was taken in the "as hobbed" condition. The errors in the involute marked in on the chart were determined by comparing the deviations with the theoretical deviations in Fig. 4.

While the profile checking of large industrial and marine gears is relatively new, the checks taken up to the present indicate that the machine will be of value in determining whether tooth profile accuracy is being maintained through various manufacturing operations, such as hobbing, shaping, lapping, and shaving. In addition to this, worn gears can be checked to determine how wear has modified the profiles—information that is of particular interest to the designer. A still further use, which will no doubt become more important in the future, lies in checking the contour of a tooth profile that has been modified to take care of deflections when the gear is subjected to heavy loads.

* * *

Cracks in Cemented-Carbide Tools

When cracks are found after grinding cemented carbide tools, the source of the difficulty can often be determined from the nature of the cracking. Norton engineers state that if only extremely fine surface cracks are present, they are caused entirely by too severe a grinding operation. Easily visible cracks that start near the brazed joint may be due to very high stresses left after the brazing operation, the additional grinding stresses being enough to cause cracking; or they may be due to rapid localized heating of the steel shank when it is ground without making contact with the carbide, in which case excessive stresses are set up by the difference in thermal expansion of the steel and cemented carbide.

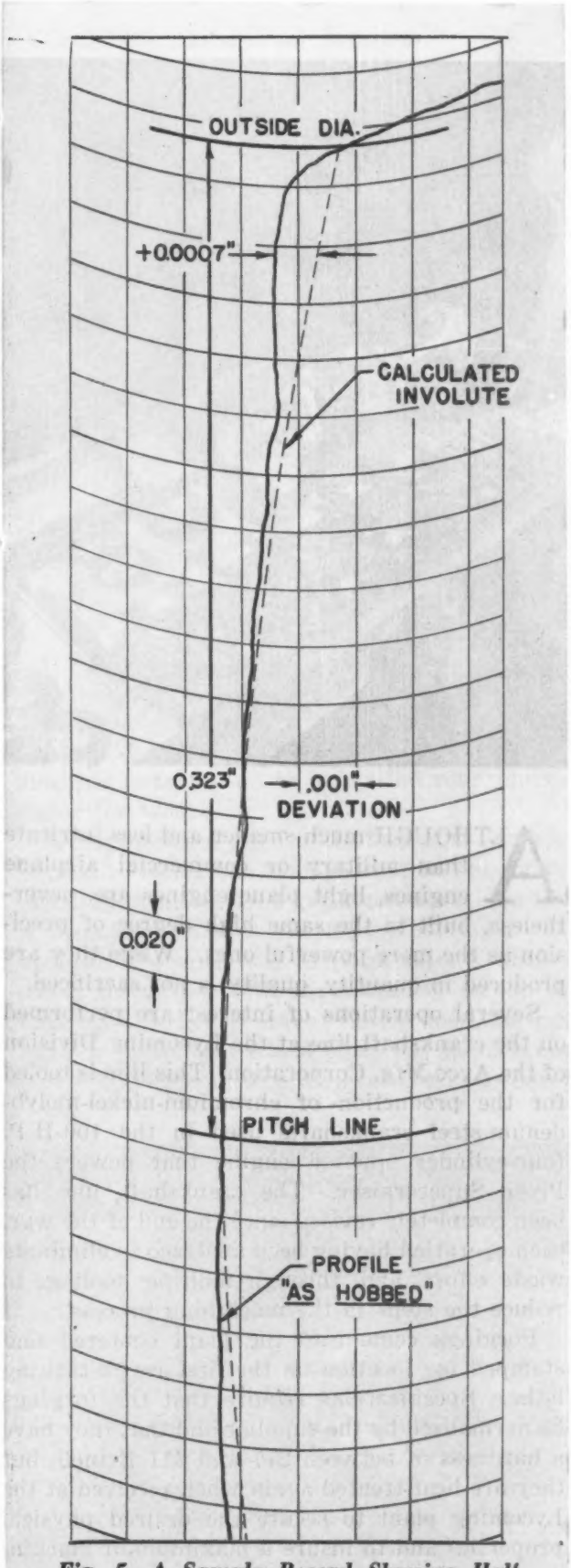


Fig. 5. A Sample Record Showing Half the Profile of the Driven Side of a Gear Tooth. Errors in the Involute were Determined by Comparing the Deviations with the Theoretical Deviations in Fig. 4

Machine-Shop Operations in

ALTHOUGH much smaller and less intricate than military or commercial airplane engines, light plane engines are, nevertheless, built to the same high degree of precision as the more powerful ones. While they are produced in quantity, quality is not sacrificed.

Several operations of interest are performed on the crankshaft line at the Lycoming Division of the Avco Mfg. Corporation. This line is tooled for the production of chromium-nickel-molybdenum-steel crankshafts used in the 100-H.P. four-cylinder opposed engine that powers the Piper Supercruiser. The crankshaft line has been completely revised since the end of the war, each operation having been analyzed to eliminate waste effort, and, through multiple tooling, to reduce the steps in the machining process.

Forgings come into the plant centered and stamped for location on the first rough-turning lathe. Specifications require that the forgings be normalized by the supplier and that they have a hardness of between 277 and 311 Brinell, but they are heat-treated again when received at the Lycoming plant to secure the desired physical properties and to insure a maximum of machinability and hence a minimum of tool breakage. The crankshafts, which are forged from AMS 6415 alloy-steel stock (SAE 4340) are normalized in Leeds & Northrup Homo tempering furnaces at 1150 degrees F. for five hours. From the heat-treating department they are sent to the shop, where more than fifty-five machining, grinding, and inspection operations are performed prior to installing the crankshafts in the engines.

Although, as previously mentioned, the forgings are centered when they come from the foundry, they are recentered in an Aurora drill press, and are then transferred to a Fay automatic lathe. Here they are located by a pointed spring-backed pin, mounted on the headstock of the lathe. The headstock center is air-operated. Before locking the shaft between centers, the operator checks its position with the locator pin. If it is incorrectly located, he can advance or retract the tailstock center with the handwheel, since the air pressure on the headstock is neither so strong nor so weak as to preclude some shifting of the shaft. Thus, the operator can position the shaft so that the punch mark on the first crankpin bearing is in line with the locator pin, thus insuring correct location for subsequent machining and grinding operations.

The operations performed on this machine are rough-turning the front main bearing; forming the oil seal and turning the oil-seal diameter; turning the outside diameters of the flange and oil seal; and facing the front and back side of the flange. Formerly, these surfaces were machined in three different lathes, but it was found that by tooling an automatic machine as illustrated in Fig. 1, all cuts could be made simultaneously.

High-speed steel tools, some of which are tipped so that the shank can be rehabilitated after the cutting edge has been worn, are used for turning, facing, and forming all diameters.

Producing Light Aircraft-Engine Crankshafts

By M. F. COLBURN, Chief Tool Engineer
Lycoming Division, Avco Mfg. Corporation
Williamsport, Pa.

Tipped tools are employed for turning the outside diameter of the flange and oil seal because it is on these surfaces that the cut is the heaviest and the surface speed the highest. The cutting speed used in turning the flange is 30 surface feet per minute, the feed is 0.010 inch per revolution, and the depth of cut is 3/32 to 1/8 inch. Although this appears to be a relatively slow cutting speed, the material is extremely tough and the cuts are heavy; at higher speeds, the tools would be burned or chipped.

Five tools are mounted in the back tool-block, which is inclined at an angle of about 45 degrees with the horizontal center line of the shaft, while four tools are mounted in the front tool-block, which is inclined at an angle of approximately 20 degrees below the center line of the shaft. These tools are advanced to the work and fed automatically. Close tolerances are not required on this operation, 0.010 inch being allowed on diameters and at least that amount on lengths.

From here, the crankshafts are routed to a Landis cylindrical grinding machine, where the front main journal is rough-ground; this grinder is equipped with a 30- by 4- by 12-inch vitrified wheel, operating at a speed of 6500 surface feet per minute with a depth of cut of 0.016 inch. The center and rear main journals are then turned on other Fay automatic lathes, which also are tooled to make all cuts simultaneously, after which these surfaces are rough-ground on a Landis 14- by 48-inch grinding machine using a 30- by 1 3/4- by 12-inch wheel. The shaft is located for all operations from the face of the front crankpin bearing.

A finished and ground locator block is mounted on the ways of the grinding machine, as shown in Fig. 2. The work is placed between the spring-mounted headstock center and the tailstock, and a feeler gage is forced between the front crankpin face and the locator block. The tailstock center is advanced or retracted until the gage is a "Go" fit, after which the headstock center is locked, and the feed of the grinder engaged.

The surface speed for the plunge-grinding operation on the center and rear main journals is 6500 feet per minute. The center journal is the first to be ground. A Pratt grinding gage makes a continuous check on the diameter, and the dimensions are held to 0.001 inch. On the completion of this operation, the carriage of the machine is traversed to bring the rear journal under the wheel.

A dial indicator gage on the base of the grinder is used to locate the rear journal in the correct grinding position. This gage controls a stop that is fastened to a slide bar on the carriage. The operator traverses the carriage rapidly until it comes in contact with the actuating pin on the indicator; it then is moved slowly until the indicator is at zero, at which point the shaft is correctly positioned. The stop on the slide bar is

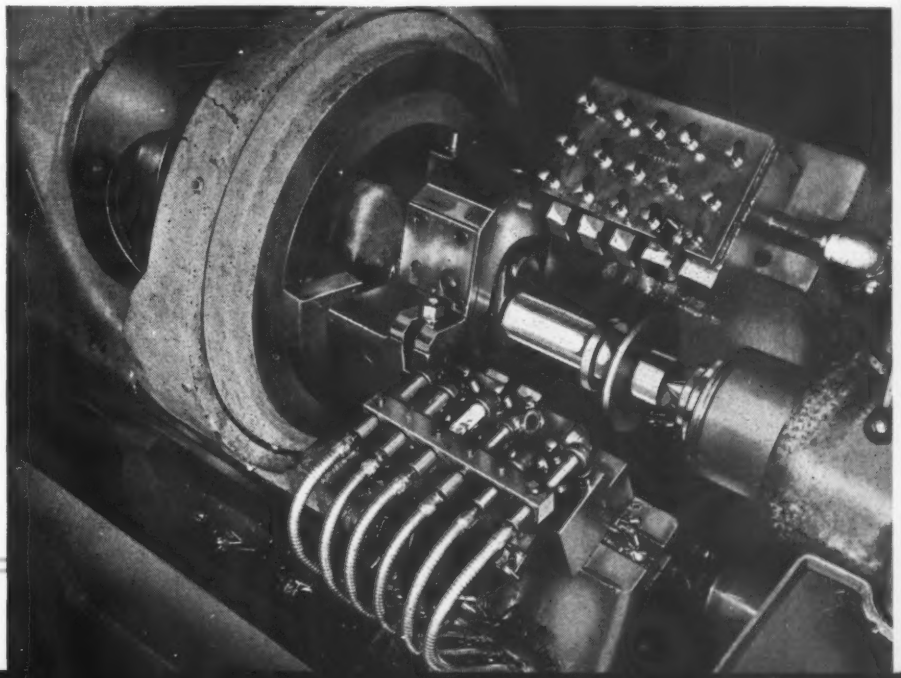


Fig. 1. Seven High-speed Steel and Two Carbide Tools are Used on This Automatic Lathe to Rough-turn Front End of Crankshaft, Form Oil-seal Diameter, and Turn and Face the Flange

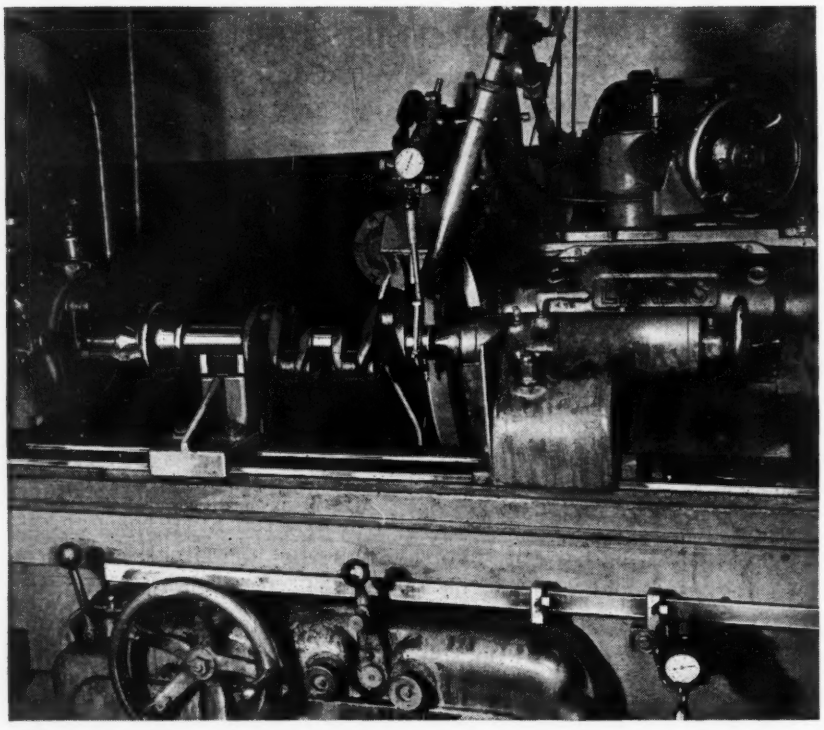


Fig. 2. The Crankshaft is Located for Rough-grinding the Center and Rear Main Journals by a Finished and Ground Block Mounted on the Ways of the Machine, together with a Dial Indicator Gage on Base and a Stop on Carriage

held in place by a set-screw, and is adjusted periodically to insure accuracy. This arrangement was made and installed in this plant, and has saved considerable time in setting up.

After these rough turning and grinding operations, the shaft is straddle-milled to remove excess metal from the end, the front end is drilled, and the flange and oil-groove are semi-finished. The milling operation is performed on a Cincinnati duplex milling machine, using right- and left-hand inserted-tooth cutters. The cutters are 5 inches in diameter, and have a 1 1/2-inch bore. The rotational speed is 60 R.P.M., giving a cutting speed of 78 surface feet per minute. The depth of cut is 7/32 inch, and the feed about 0.025 inch per revolution.

The Warner & Swasey turret lathe used to drill the front end and machine the flange is tooled to perform the following operations: On the square turret, face flange and form oil-plunger groove. On the hexagonal turret, (1) spot-drill end; (2) drill a 1 27/32-inch hole 7 7/8 inches deep; (3) drill a 1 15/32-inch hole clear through with drill ground to form an angular surface at the bottom; (4) finish-ream angular surface at bottom of hole; and (5) finish-ream a 1 1/2-inch hole clear through.

On the drilling operations, core drills are used to provide a passage for the coolant and prevent burning of the drill. A chip-breaker also is ground on the drill.

The next operation of interest (the crankpins

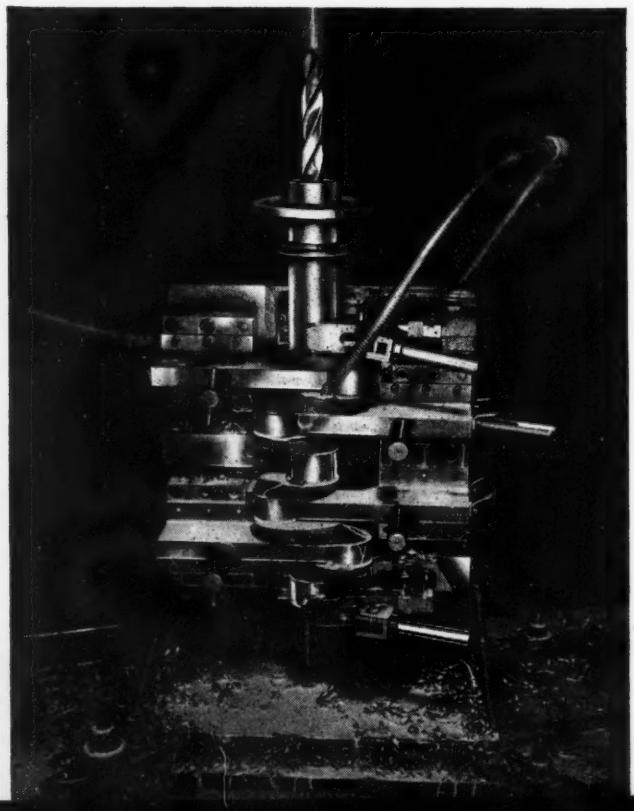


Fig. 3. Fixture Used to Hold the Crankshaft while Drilling the Main and Crankpin Bearings. Retractable Bushings Guide the Drill during Spotting

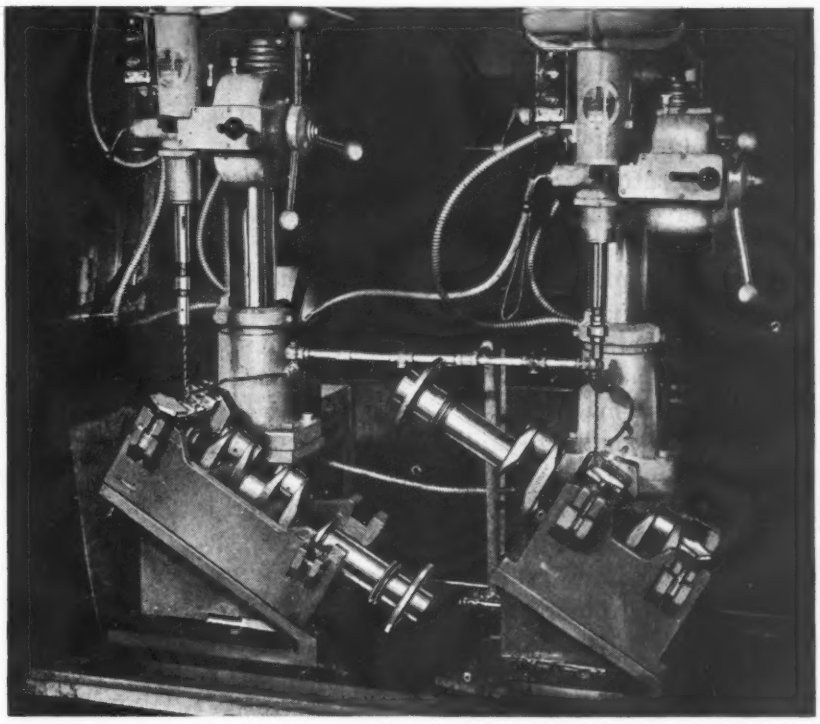


Fig. 4. Light Drilling Machines are Used to Drill and Ream Crankpin Oil-holes. Note the Fixtures Used to Hold the Crankshaft in the Correct Position for Drilling the Holes at the Required 30-degree 21-minute Angle

are turned and cheeked in a conventional manner on a Wickes crankpin lathe) is the drilling of the main bearing on a 24-inch Cincinnati drill press with a 1 1/16-inch drill having an over-all length of 25 inches and a flute length of 20 inches. The fixture used for this operation is unique in that it has sliding bushings that can be advanced to guide the drill during spotting operations and retracted during drilling, as shown in Fig. 3.

When the shaft is mounted in the fixture, the front face of the first crankpin journal rests against a stop-block, and the shaft is cradled in V-blocks, spaced at intervals along the length of the fixture. Two cam-operated clamps are then swung into position and fastened; all bushings are set in line with the drill, and the feed of the press is engaged.

After the front bearing is drilled and the first crankpin journal spotted, the feed is stopped, the drill backed off, and bushing No. 1 retracted. As will be noted from the illustration, the bushing is located by a spring-mounted pin that fits into a hole in the fixture, and hence cannot be knocked out of alignment. The same drilling sequence is followed on all main crankshaft bearings, and a similar fixture and sequence are used for drilling the crankpin bearings. The main bearings are drilled with a high-speed steel drill using a peripheral speed of 40 feet per minute and a feed of 0.007 inch per revolution.

On completion of these operations, the shafts

Fig. 5. The Crankshaft for the Four-cylinder 100-H.P. Engine Used in the Piper Supercruiser Must be in Static Balance within 1 Ounce-inch

are transferred to the heat-treating department for stress relief. This minimizes machining stresses and consequent distortion during the nitriding operation. For the stress relief, the work is held in an electric furnace for five hours at a temperature of 1100 degrees F. These furnaces have a capacity for twenty shafts; they are 440-volt, 30-cycle, three-phase units of 72 kilowatts maximum heating capacity, and are equipped with a circulating fan to insure even distribution of the heat. After stress-relieving, the shafts are sand-blasted and sent back to the shop for finish-machining.

Subsequent drilling, milling, and grinding operations on oil-holes, lightening holes, crankpins, and bearings are in accord with general practice. Light drill presses, shown in Fig. 4, are used to drill and ream the oil-holes at a 30-degree 21-minute angle in the bearings.

Nitriding is done in two Westinghouse Bell type ammonia-atmosphere furnaces in lots of 150 crankshafts. The shafts are heated for forty-five hours at a temperature of 975 degrees F., at the end of which time they are hardened to a depth of approximately 0.005 inch. The resultant shaft is tough and resilient because of the chromium-nickel-molybdenum consistency, and is hard and wear-resistant in the bearings and journals.

After the final machining operations, the front of the shaft, from the oil-groove to the end, is cadmium-plated to a depth of 0.0004 inch to provide protection against the atmosphere. The bearings are then polished and lapped on a Hendey engine lathe with an abrasive aluminum-oxide cloth of 240 grit. Although a surface roughness as high as 10 micro-inches r.m.s. is permissible, the final finish is around 6 to 8 micro-inches.

The shaft is now balanced, both statically and dynamically. It is held in static balance within 1 ounce-inch, and is dynamically balanced within 20 ounce-inches. Any correction necessary is made by grinding on a floor-stand grinder, which leaves a smooth surface not likely to accumulate dirt. Lastly, the shaft is inspected by the "Magnaflux" process for cracks or other defects not visible to the naked eye, and checked for dimensional accuracy before being sent to the assembly line.

Into This Weather Chamber at the Industrial Electronics Division of Westinghouse Goes Part of the Equipment for a Radar Unit being Built for Use aboard U. S. Navy Warships. When the Heavy Door is Closed, Engineers Can Subject the Equipment to Temperatures Ranging from Minus 75 Degrees F. to 200 Degrees above Zero, thus Simulating Operating Conditions from the Tropics to the Antarctic. In Addition, Pressure Controls Make Possible the Testing of Aircraft Equipment under Varied Atmospheric Conditions of Altitudes up to 80,000 Feet

A Billion-Dollar Investment in America's Future

GOVERNMENT agencies that are accustomed to spending gargantuan sums may not consider one billion dollars a particularly impressive amount, but to business men who accumulate funds by the profit and loss system, a billion dollars is a lot of money. It represents a tremendous amount of work done by thousands of men and women. To earn a billion dollars, every man, woman, and child in the United States would have to expend sufficient energy for some business enterprise to pay them each an average of about $7.50.

So when the steel industry announces that by 1948 it will have spent one billion dollars for plant expansion, it means that the men who run that industry have strong faith in the immediate industrial future of this country. They have the courage to start a ball rolling that will insure continued prosperity for many other business enterprises.

For many years prior to the war, our steel-making capacity was considerably higher than market demands, and back in 1932 steel production fell as low as 19.2 per cent of capacity. Therefore, when the steel industry proposes to expand production facilities to the tune of 2,500,000 tons annually, it means that the industry confidently expects our present high level of production to be maintained for a long time to come—at least long enough to make the investment a profitable one. It means that the steel industry has no time to listen to pseudo-economists who have been predicting a depression for the last year or so.

To add 2,500,000 tons to our present capacity of 91,000,000 tons may not seem a great expansion off hand, but the addition alone represents 20 per cent of the total production of so important a country as Great Britain. It will help to eliminate the bottleneck of steel shortage that is now a serious handicap in the making of automobiles, the production of railway equipment, and the manufacture of a hundred and one other products for which there appears to be an insatiable demand.

In effect, the steel industry is investing one billion dollars in America's economic future.

Charles O. Herb

Fine Finishes and Flatness

THE chief developments in surface grinding during the last few years have been an expansion of the scope of the process in the direction of finer finish and greater flatness and an extension of its application to many non-metallic materials. These developments were stimulated by production problems that arose in making war material.

The field of surface finishing performed on Blanchard grinding machines includes all grades of finish from the roughest obtainable with a 14-grit wheel to a finish of less than 2 micro-inches. The flatness may be within a few thousandths of an inch on rough-ground surfaces or it may be so fine as to show an error of only one or two light bands when tested with an optical flat.

The quality of surface finish obtainable depends somewhat on the hardness of the material and the dimensions of the work. Materials such as hardened steel can be ground to a finish of 2 micro-inches or less in regular production, whereas on softer materials it may be difficult to obtain a finish of 10 micro-inches. The following figures will serve as a guide to the finish obtainable on different materials. The figures given are approximate, as they vary with variations in hardness of a particular material. It is easier to produce fine finishes on hard materials because of the much smaller depth of cut taken by each abrasive grain, as compared with that taken in a soft material.

Material Ground	Finish Obtained
Hardened Steel	2 micro-inches
Soft Steel	5 micro-inches
Cast Iron	5 micro-inches
Brass	12 micro-inches
Aluminum	15 micro-inches

All these ground surfaces—from the roughest to the finest—show marks or scratches made by the grains of the grinding wheel. While a part finished to 2 micro-inches appears to have a polished surface, close examination will show minute abrasive grain marks. If the machine is correctly adjusted for flat grinding, there will be two sets of curved marks, criss-crossing each other over the entire ground surface. The presence of two sets of marks, approximately equal in depth and crossing each other at all points, is proof that if any portion of the surface is tested and found to be flat, the entire surface must be flat. A useful application of this fact is that one piece of a load of parts having this characteristic criss-cross of curved lines can be tested, and if found to be flat, it will be known that all the parts in the load are flat.

For securing the finest finish and maximum flatness in surface grinding, the work-piece should be reasonably thick with respect to its length and width, or diameter. A part having a comparatively thin section may spring slightly during the grinding process. The result is either an uneven quality of finish or greater variations of flatness, or both.

In the case of cast iron, as finer and finer finishes are obtained, a point is reached where the grain structure of the material becomes quite visible. Hence, on such cast material, there is a definite limit beyond which the finish cannot be improved.

A 2-inch diameter disk is shown in Fig. 1 being measured for flatness by means of monochromatic light and an optical flat. As indicated by the straightness, parallelism, and even spacing of the light bands, the surface is perfectly flat, except for a one-half light band deviation at the extreme edge of the disk. Since one-half of a light band is only 5.8 millionths of an inch, this disk is extremely flat.

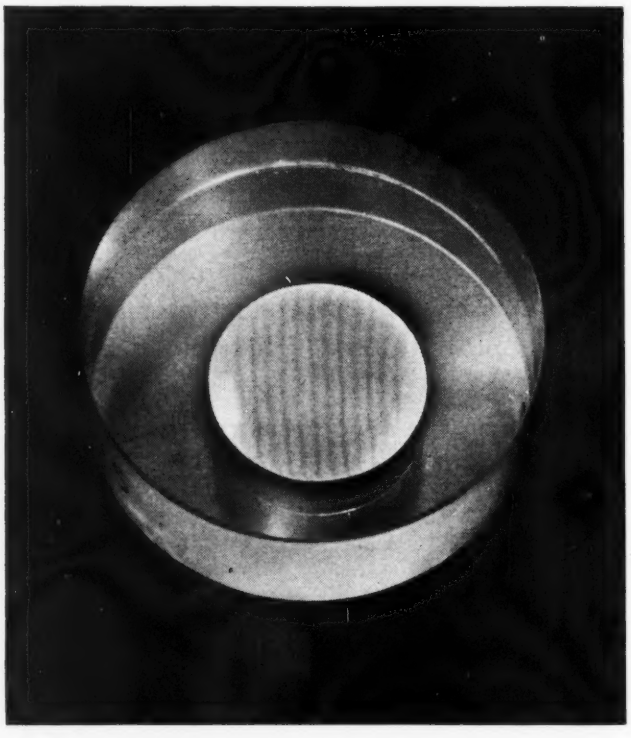


Fig. 1. A Surface-ground Disk Being Inspected for Flatness by Means of Monochromatic Light and an Optical Flat

Obtained by Surface Grinding

Results like this cannot be obtained in production work, but this sample piece can be duplicated any number of times by a skillful operator who takes the necessary care. An important manufacturer of fine precision scientific instruments is producing hardened steel toolmakers' flats, using surface grinding machines to obtain both the fine finish and the high degree of flatness required without any subsequent finishing operation.

Ground, high-pressure valve wedges of stainless steel (such as shown in Fig. 2) with no subsequent lapping or finishing, withstand pressures up to 600 pounds per square inch. The finish obtained on these wedges is from 5 to 6 micro-inches. The reflection of the small wedge can be seen in the ground surface of the larger wedge in the illustration. Another example of the pressure-tight quality of surfaces produced by surface grinding is the sides of ball-bearing inner races, which are being ground to a finish of 1 1/2 micro-inches and flat within two bands of light. Such races are used as one surface of a rotary shield.

Valve plates that have holes or ports in their surfaces can be readily ground flat with no low spots near the openings. The quality of finish obtained varies with the material from approximately 2 micro-inches for hardened steel to 4 to 6 micro-inches for fine-grained cast iron. Such surfaces are used as they come from the grinding machine, without lapping.

A good operator can learn to produce finishes such as described. The machine must be in good condition and clean; the correct work speed and feed must be used; and the grinding wheel must be selected to fit the job.

The machine should be thoroughly clean before starting fine-finish work, to prevent scratches in the surface of the work caused by loose grains of coarse abrasive. Whenever possible, it is better to reserve one machine for fine work. This saves having to clean the machine, true the chuck face, and perhaps adjust the column and change the grinding wheel.

In producing surfaces of a few micro-inches finish and of a flatness measured in light bands, the grinding cannot be hurried. The rate of removal of metal must be slow, the wheel pressure very light, and the wheel face sharp. It is desirable first to grind the surface to within 0.005 inch or less of the final size on another machine, using a wheel of conventional grit and grade, and then transfer it to the finish-grinding machine for final sizing and finish.

Fig. 2. Stainless-steel Valve Wedges which have been Surface Ground, with No Subsequent Lapping, to Withstand Pressures up to 600 Pounds per Square Inch

Any tendency of the work to distort because of thin sections or internal stresses will be more troublesome in the case of such fine work. Therefore, the material should be as free as possible from any internal stresses, and of a shape and section that will not readily distort. This should be given consideration in the design of parts on which any finely finished or extremely flat surfaces are required.

The selection of the grinding wheel is always important, but this is especially true when finishes of less than 20 micro-inches are desired. For the finer grades of finish, the wheel may be as fine as 220 grit, and for extremely hard materials such as carbides, sapphires, and some ceramic materials, a fine diamond wheel may be required. No special coolant is needed, except when using a fine diamond wheel, and it is not necessary to filter the coolant.

* * *

According to *Press Proofs*, published by the Hydraulic Press Mfg. Co., American industry is spending at the rate of $500,000,000 a year for research into new processes and new products.

What is the Big Job Now for

By BERNARD LESTER
Assistant Industrial Sales Manager
Westinghouse Electric Corporation

THE greatest Machine Tool Show in history is past. But its thrilling picture projects for the thoughtful observer the outline of a problem of challenging proportions. This problem is to sell the individual machine to individual purchasers. It was not enough that the Show attracted the eyes of industry in a strikingly dramatic way—the machines must still be sold. That job must be done by the sales engineer.

Herein lies the problem. Because of the seller's market existing throughout the late thirties and the war years, and the disruption of many selling organizations by the induction of experienced sales engineers into the armed services and government agencies, many sales organizations are not efficiently set up for the job ahead. And this job is going to be more difficult than ever before. A recent survey has shown that most machine tool builders have greatly increased their productive capacity during the last decade without any appreciable increase in their sales organization.

But an increase in the size of the sales force is not the answer. What we need most to parallel the energy and skill in design and production of present-day machine tools is a rejuvenation in energy and skill of the machine tool salesman. Besides this, a new crop of sales engineers must be trained, for we undoubtedly approach the most competitive period in industry's history. Yet we enter a period of greatest opportunity for the machine tool salesman. Never have the eyes of factory management been so closely focussed upon cost-saving equipment and the importance of making the machine fit the man rather than tax his power and adaptability.

The importance of the sales engineer (and of sales engineering) is not always recognized even by his principal, associates, or customers. As the sales engineer creates nothing that you can touch or feel, there is often a mystery about his work to his practical-minded associates—a feeling that his hours are short and purse strings loose, and that he supports himself on the magic art of persuasion, unhampered by rule or reason. Often being an individualist, he finds difficulty in analyzing his own operations and in training others. Yet sales engineering is a science, and its procedure can be logically outlined because it incorporates principles that apply to forces and materials, to business methods, and to human behavior.

What are the requirements for a capable machine tool salesman? First of all, he must not be simply an order-taker or canvasser—not even a merchandising salesman. He must have two keen eyes—an engineering eye and a business eye. He must have an active and resourceful brain, packed with technical and economic facts —one that can analyze and evaluate factory processes and procedure. He must have a couple of tireless legs, not stretched on the desk, but legs that carry him through customers' plants.

His job is to convincingly prove definite profit-earning results from machine tools properly applied. He must sell ideas for performing operations better through the use of equipment that

The greatest problem that challenges the machine tool industry today is not production. It is distribution. It is engineering the use of the tool. It is putting the machine tool to work. It is transforming the idle unit on the shipping platform into a live unit earning its way in a family of other machines. It is convincing the customer through the use of fact and logic that he should invest in the machine tool to insure future economic returns. It is selling.

Machine Tool Builders?

his firm can supply. His work is never complete until what he has sold yields a profit for his customer.

"I know the works equipment people all right. I get their inquiries right along, and follow them up." This statement was recently made to me by an experienced machine tool salesman in referring to one of his important customers. He was depending on the inquiry. He was a "response" salesman, and a good one because he had a record of selling the right tool for the job and making it yield. But did he know this customer's extension and rehabilitation plans? Did he get into the critical aisles in their plant? Did he persuade them to give him an opportunity to analyze their machining methods over an area where his machine tools might serve? Did he gather facts, evaluate them, and then come across with new ideas on cost reductions that could be realized by putting his tools to work? No—he was a good old-time salesman. He responded—but he did not aggressively create.

On asking another salesman, "Are you adding new customers to your list?", I got the reply, "Lord no! It is only recently that I have been able to take care of old ones." This was a natural, honest reply, but will that policy get the salesman far in the future? New plants—often involving new locations, new processes, and new products—are cropping up here and there. The machine tool salesman of the future must keep informed. He must have that sixth sense of detecting new business possibilities. Above all, he must be resourceful.

"Do you know Carl White?" was another question asked a machine tool salesman; "he's just been put in charge of the tool-room out at the Westminster plant." "No," was the answer, "can't keep track of all these changes." Never before has customer personnel been so actively reshuffled or so many new faces added. The machine tool salesman of the future must be informed and alert; he must possess the ability to spot responsible customer personnel and reach them quickly. Businessmen, bankers, friends in other machinery lines, the public, and the trade press—these and many more are sources of information and contact.

Little in selling is new. Most everything has been tried out somewhere at some time. What is vitally needed is to discover every available resource and then put it to use in a positive way. Aside from his customer relations, the machine tool salesman can be the best source of information for the designer and production executive of the machines he sells. He can be a livening influence within his own organization, so that all will get the customer point of view.

Machine tool sales engineers must be trained to meet present-day needs. This cannot be accomplished over night with a $25 course in salesmanship. Long preparation of the individual is necessary because he must build upon a foundation of technical knowledge, understanding of business principles applied largely to production economies, and an appreciation of human conduct. The immediate job of management is to develop a true understanding and appreciation of sales engineering; to analyze the technique of respective sales departments, with a view to developing better methods through constructive criticism; and to develop sales engineering training programs that will adequately equip young men for the job. This is the big job now for the executives of machine tool building concerns.

* * *

Research Rockets to Ascend 235 Miles

Rockets that will reach a speed of 8500 feet per second are being built by the Glenn L. Martin Co., Baltimore, Md., for the U. S. Navy. These rockets, known as "Neptunes," will supplant the fast disappearing supply of German V-2 rockets.

The 8500 feet per second speed will be reached when the rocket is carrying a payload of 100 pounds, and will occur at 38 miles above the earth's surface, seventy-five seconds after launching. At that height and time, the fuel supply of liquid oxygen and alcohol will be exhausted, but the "Neptune" will "coast" on straight up for another 197 miles to a total height of 235 miles—more than twice the height reached previously by a V-2.

The first of the full-sized rockets is expected to be ready for launching by June, 1948. The "Neptune" will be 45 feet long—about the same length as the V-2—but will be much slimmer, having a diameter of only 32 inches.

* * *

It was the enormous productive ability of the United States that was our real secret weapon during the war.—*C. E. Wilson, President, General Motors Corporation*

Expansion Fitting with Liquid Nitrogen

By CHARLES H. WICK

SOLID carbon dioxide (dry ice) has been used for some time to contract metal parts that are to be expansion fitted. However, the temperature of dry ice (about 109 degrees F. below zero) is not low enough to contract the parts sufficiently in some cases to permit them to be inserted in holes or recesses. During the war, many aircraft-engine and other parts were expanded into sub-assemblies by first cooling them in liquid oxygen. Now high purity liquid nitrogen, which has a temperature of about 320 degrees F. below zero, has replaced liquid oxygen for this purpose, because of its greater safety. The chart Fig. 1, showing linear thermal expansion and contraction for various metals and temperatures, indicates the greater contraction possible with such low temperatures.

Heating of the outer part for subsequent shrinking onto the inner member at assembly is theoretically the most economical method of obtaining this type of fit. However, certain steels and most aluminum alloys may be warped or have their hardness reduced by heating to the temperatures required for a shrink-fit assembly. Sub-zero cooling is especially advantageous for fitting inserts into large complex parts that would be distorted by heating. As can be seen from Fig. 1, to obtain an expansion corresponding to the contraction possible with liquid nitrogen, a temperature close to the tempering range of some materials would be required.

Liquid nitrogen is an inert material that boils at minus 320.4 degrees F. and freezes at minus 345.75 degrees F., both at atmospheric pressure. It is colorless, odorless, and—to all outward appearances—resembles clear water. Nitrogen will not support combustion.

Liquid air, which consists essentially of liquid nitrogen and oxygen, should not be used, because the nitrogen tends to boil off at a faster rate than the oxygen, and high concentrations of liquid oxygen result. Although the gas given off from evaporating liquid nitrogen is inert and non-toxic, its concentration in the atmosphere should be avoided, as it may cause on oxygen deficiency for breathing. If liquid nitrogen comes in contact with the skin or eyes, it will cause effects similar to burns.

The amount of liquid nitrogen, in cubic feet, required for expansion fitting a pound of metal is given in the accompanying table, together with the inch shrinkage per inch of diameter for

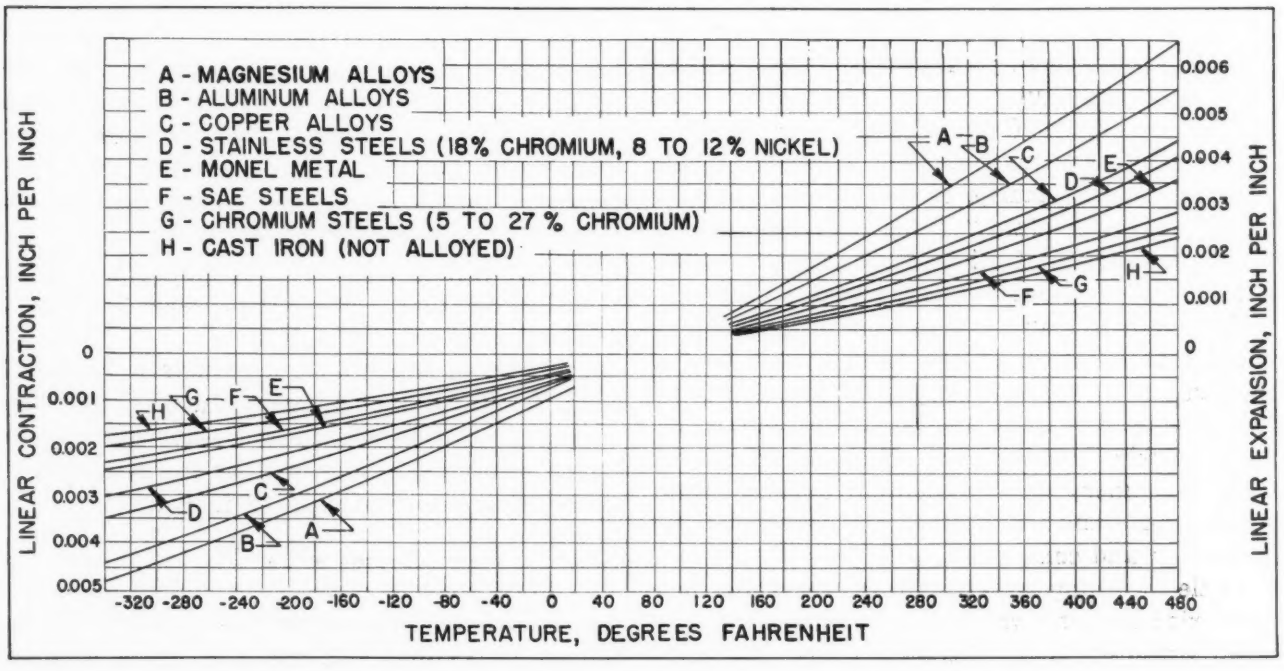

A - MAGNESIUM ALLOYS
B - ALUMINUM ALLOYS
C - COPPER ALLOYS
D - STAINLESS STEELS (18% CHROMIUM, 8 TO 12% NICKEL)
E - MONEL METAL
F - SAE STEELS
G - CHROMIUM STEELS (5 TO 27 % CHROMIUM)
H - CAST IRON (NOT ALLOYED)
LINEAR CONTRACTION, INCH PER INCH
LINEAR EXPANSION, INCH PER INCH
0
0.001
0.002
0.003
0.004
0.005
0.006
-320 -280 -240 -200 -160 -120 -80 -40 0 40 80 120 160 200 240 280 320 360 400 440 480
TEMPERATURE, DEGREES FAHRENHEIT

Fig. 1. Chart Showing Linear Thermal Expansion and Contraction of Metals at Various Temperatures within an Accuracy of Plus or Minus 10 Per Cent

Fig. 2. Stainless-steel Insulated Bucket Employed in the Expansion Fitting of Small Parts with Liquid Nitrogen. The Parts are Dipped in Bath with a Perforated Ladle

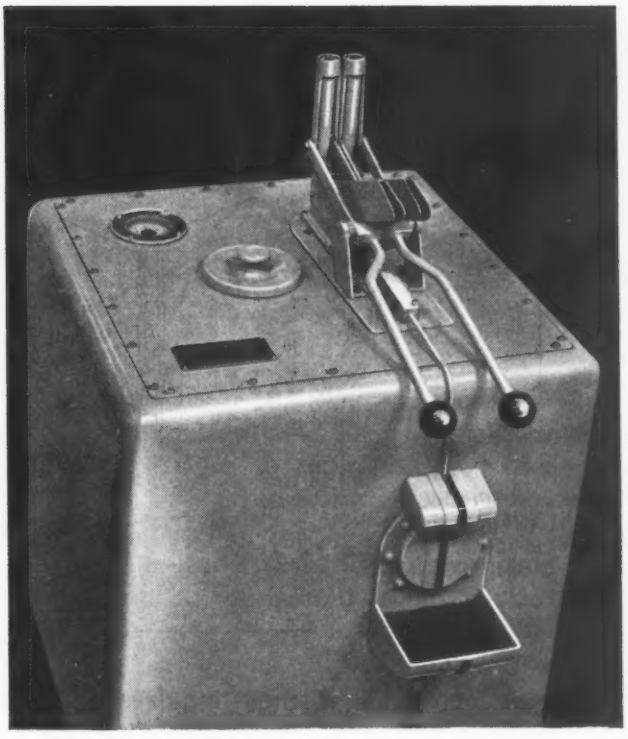


Fig. 3. Direct-immersion Type of Liquid Nitrogen Shrinking Machine that Accommodates Cylindrical Parts from 1 1/8 to 2 1/4 Inches in Diameter by 5/16 Inch Thick

various metals. These consumption values were calculated for one pound of the metal immersed in the liquid nitrogen without precooling. If the parts are precooled with the gases evolved from the nitrogen bath, the consumption values should be multiplied by 0.6. The shrinkages given are for a temperature drop of from 75 degrees F. to minus 321 degrees F., and for parts 1 inch in diameter. Other sized parts shrink proportionately; for example, a 2-inch diameter shaft will shrink twice the value given.

Machining tolerances on parts to be expansion fitted vary with manufacturing practice. However, the following typical shrinkage fit assemblies indicate the general range of tolerances used. For an S A E steel shaft having a nominal diameter of 1 inch and a total shrinkage of 0.0022 inch, the shaft can be machined to 1.0018 inches + 0, — 0.0005 inch, and the bore can be held to 1.0000 inch — 0, + 0.0005 inch. This provides a maximum interference of 0.0018 inch and a minimum interference of 0.0008 inch. For a steel shaft having a 2-inch nominal diameter and a total shrinkage of 0.0044 inch, the shaft can be turned to 2.0035 inches + 0, — 0.001 inch, and the bore machined to 2.0000 inches — 0, + 0.001 inch. A maximum interference of 0.0035 inch and a minimum interference of 0.0015 inch is thus provided.

High purity liquid nitrogen is available through The Linde Air Products Co. in small portable containers and in a mobile 105-gallon servicing container. The latter consists of a vacuum-insulated storage tank, mounted on a four-wheel truck, which can be readily filled from a transport or storage tank. The liquid nitrogen is poured like water from the smaller containers. It is pumped from the mobile container. Pressure built up by evaporating some of the liquid nitrogen is used to force the liquid from the tank.

Metal Shrinkage and Consumption of Nitrogen for Expansion Fitting

Material	Inch per Inch of Diameter Metal Shrinkage	Cubic Feet of Liquid Nitrogen Required per Pound of Metal
Magnesium Alloys	0.0046	14.3
Aluminum Alloys	0.0042	12.5
Copper Alloys	0.0033	5.7
Chromium-Nickel Steels (18-8 to 18-12)	0.0029	6.0
Monel Metal	0.0023	6.0
S A E Steels	0.0022	6.0
Chromium Steels	0.0019	6.0
Cast Iron (Not Alloyed)	0.0017	7.0

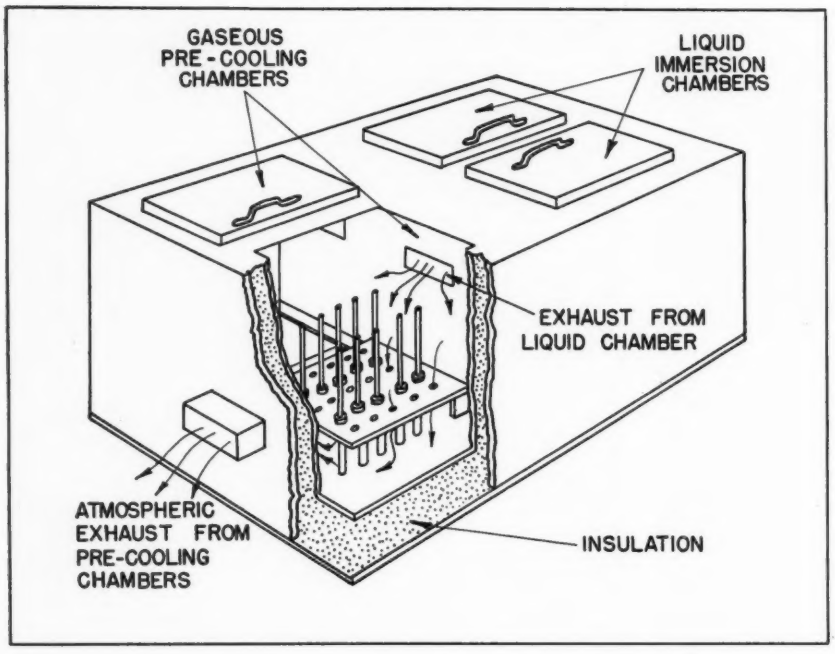


Fig. 4. Separate Chambers are Provided in This Unit for Precooling the Parts that are to be Shrunk by Means of Vapor Boiling off the Liquid Nitrogen

Normal expansion fitting requires simple equipment only and relatively little nitrogen. Small users can employ this method economically by utilizing an insulated bucket, vented to the atmosphere. A stainless-steel insulated bucket, such as seen in Fig. 2, with an opening 4 1/2 inches in diameter by 8 inches deep is available for this purpose. Small parts can be lowered into the opening on a perforated ladle as shown. Certain materials, when cooled to liquid nitrogen temperatures, are brittle, and care must be taken in handling them to prevent breakage. When required, special equipment with automatic handling can be employed.

In Fig. 3 is shown a standard, direct-immersion type of liquid-nitrogen shrinking machine which will accommodate cylindrical parts from 1 1/8 to 2 1/4 inches in diameter, and up to 5/16 inch thick. Two parts can be placed simultaneously in the filling slots in the top of the machine. The work descends into the liquid nitrogen bath, guided by U-shaped tracks. The parts are precooled before immersion by nitrogen vapor that boils off the liquid and is exhausted from the top of the unit. By depressing either of the handles, a cold part is allowed to roll from the hinged outlet door shown in the front of the machine. Hoppers can be designed

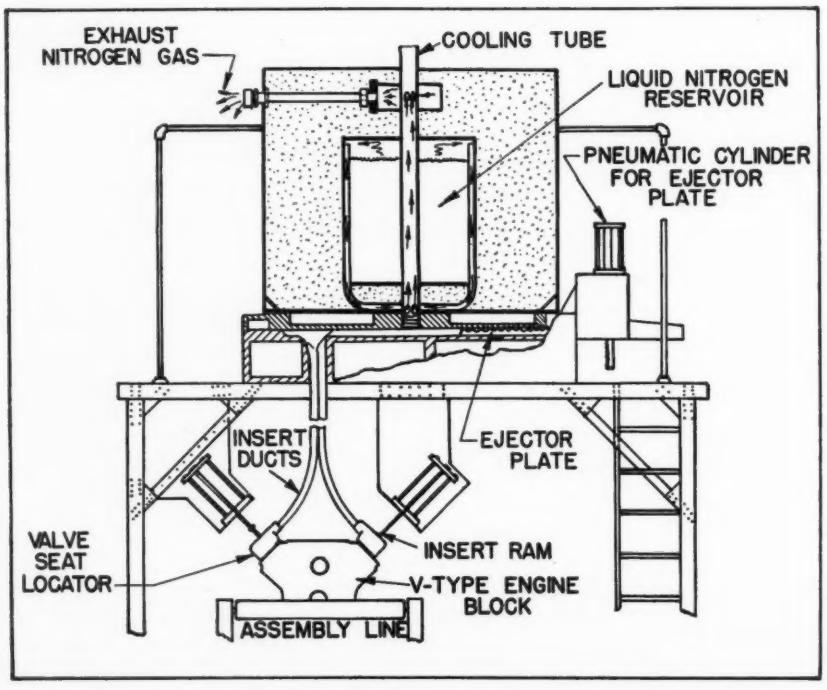


Fig. 5. Valve-seat Inserts are Fed down the Cooling Tube of This Special Automatic Unit and are Contracted by the Cold Vapor from the Liquid Nitrogen

The Vitality and Power of American Mechanical Genius

THE greatest Machine Tool Show of all time is now an event of the past, but its influence on the industry and economy of this and other countries will be felt for many years to come. The amazing new developments there disclosed for the first time will have a profound effect on manufacturing methods in all metal-working shops that strive for efficient operation.

THIS Show demonstrated to the world the capacity of the American machine tool industry to provide equipment that will insure low manufacturing costs despite high material prices and unprecedented wages for labor. It proved in spectacular fashion that the industry which provided the means for producing the implements of warfare can also supply the equipment that can maintain a peaceful economy.

ONE visitor remarked as he walked around the Show that here was the reason we had won the war. That statement was no reflection on the courage, genius, and outstanding ability of our fighting forces, which played so great a part in bringing final victory. It simply expressed the powerful impression which the Machine Tool Show gave of an industry that had risen to phenomenal heights in manufacturing capacity and engineering achievement during the war years. The same industry, now devoted to the problems of peacetime production, has developed machine tools so diversified and revolutionary that no matter how great our present-day production problems may be, means have been made available for solving them.

THE Show was a great inspiration to the many thousands of visitors, most of whom were men responsible for obtaining production results in the metal-working industries, both here and abroad. One man commented that a visit to the Show was a real education, and that it made him feel "proud to be an American and to be associated with an industry that is doing such a complete job." Anyone may well feel proud to be connected with an industry able to accomplish such a remarkable job despite the almost insuperable handicaps imposed upon it by the huge surplus of machine tools thrown on the open market at the close of the war. Any doubts about the future of American industry would have been quickly dispelled by a trip down the Show aisles.

IT is indeed unfortunate that a substantial number of political leaders and Government officials could not have been conducted personally through the Show by industrial executives. That would have given the men who shape the affairs of our nation some conception of the tremendous amount of time, energy, and creative ability required to keep the United States at the production forefront. Such an experience would have been most helpful to them in reaching important decisions in the future that will affect industry, labor, and all our people.

THE Show was living evidence of the vitality and power of American mechanical genius and of the ability of the machine tool industry to meet today's challenges. Where under the compulsion of a totalitarian government could such evidence of initiative, progress, and brilliant achievement be found? Where could one find a more certain assurance that the forward march of industry will be maintained and that the material welfare and high living standards of America will continue to advance?

Charles O. Herb

for automatic loading. The cap shown in the top of the unit at the left of the filling slots covers a well that can be used for cooling odd-shaped parts.

Another direct-immersion unit is shown in Fig. 4. This unit is equipped with separate chambers where batches of the parts are precooled by vapors evolved from the liquid nitrogen. The two liquid immersion chambers and the two gaseous precooling chambers each have a capacity for one perforated tray that holds ten sleeves and mandrels. The hinged cover of one precooling chamber has been removed and one corner of the unit has been cut away to show a tray of parts. After precooling, the trays are manually transferred to the immersion chambers for final shrinking of the parts. This unit can be built from drawings furnished by The Linde Air Products Co. Trays can be designed to handle almost any shaped part. This equipment is used where manual operation is satisfactory.

A special counter-flow type of cooling unit in which the parts do not come in contact with the liquid nitrogen is shown in Fig. 5. Vapor boiling off the liquid nitrogen in the reservoir is directed, as shown by arrows, into the lower end of the filling tube, where it rises past the descending parts and cools them prior to being exhausted into the atmosphere. The filling tube passes through the liquid nitrogen reservoir, but, as stated, the parts do not come into direct contact with the liquid.

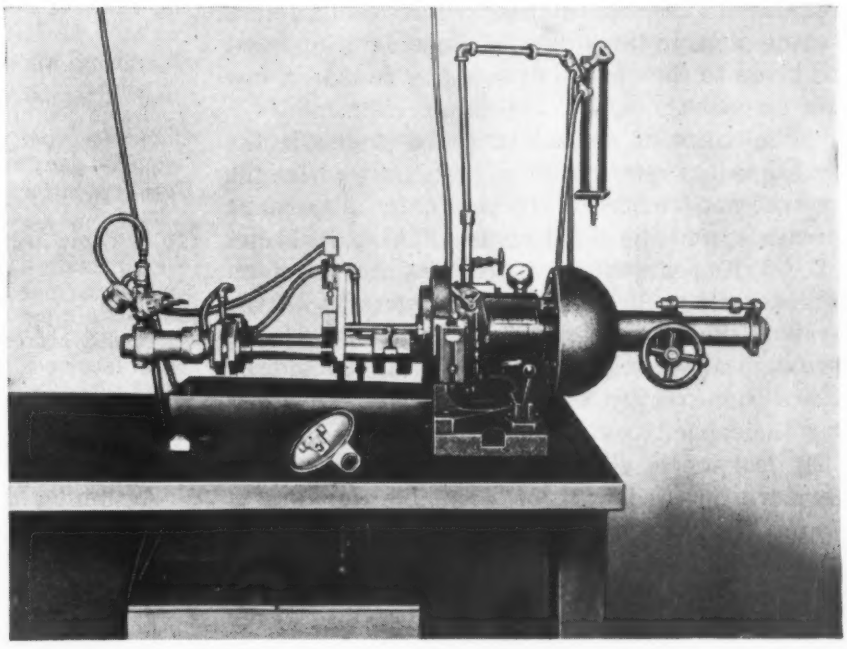
This particular application is for automatically assembling valve-seat inserts into V-type engine blocks. Several filling tubes are located behind the one shown to accommodate sufficient inserts for the requirements of a single engine block. The ejector plate, actuated by the pneumatic cylinder at the right, slides the valve-seat inserts from below the filling tubes and into the insert ducts shown. From these ducts, the inserts enter the valve-seat locators and are seated in the engine block by the rams of the pneumatic cylinders. The final expansion assembly of the parts follows.

* * *

Hydraulic Boring Machine Equipped with Special Fixture for Machining Small Parts

The accompanying illustration shows a self-contained hydraulic boring machine built by the Hydro-Borer Co., Inglewood, Calif., which is equipped with a special pedal-actuated pneumatic fixture for boring, counterboring, and facing a regulator body for butane and propane processing equipment in the plant of the L. C. Roney Corporation, of Inglewood.

The material being bored is die-cast Zamac 3 metal. A 10 micro-inch finish is obtained on this job, using a 15 to 1 ratio soluble oil coolant. The operation consists of spot-facing a 1 9/16-inch diameter; counterboring a 43/64-inch diameter to a depth of 33/64 inch; line-boring a hole 0.685 to 0.686 inch in diameter for a depth of 1 1/2 inches; and line-boring a hole 0.6815 to 0.6825 inch in diameter to a depth of 4 inches. Production on this particular job is at the rate of 120 parts per hour.



Boring, Counterboring, and Facing a Regulator Body on a Hydraulic Boring Machine Equipped with a Pedal-actuated Pneumatic Fixture

Maintaining the Correct Pressure

Causes, Effects, and Remedies of Low Air Pressures in Compressed-Air Systems. Abstracted from a Compressed Air Handbook, Compiled and Edited by the Compressed Air and Gas Institute, which is Soon to be Published by the Institute

LOW air pressure is an abuse of the compressed-air system—a costly and wasteful practice which should not be tolerated. Ignorance of the effect of low air pressure contributes more than any other single factor to a lack of appreciation of the effectiveness of compressed-air power.

By low air pressure is meant inadequate pressure at the tool or the device that is air-operated. Only the pressure and volume of air available at the point of use can be effective in doing work. Most pneumatic tools, for example, are designed to operate at 90 pounds gage maximum at the tool. If the operating pressure is below 85 pounds gage, it reduces the ability of the tool to do the maximum work for which it is designed.

Causes of Low Air Pressure

The causes of low air pressure are insufficient compressor capacity, inadequate piping, and leakage. When it is discovered that the pressure is tool low, the first inclination is to install more compressor capacity. This is not necessarily the correct procedure. It should first be determined whether the compressors are at full load when the air pressure is low. If they are, then more compressor capacity may be required, but before taking steps in this direction, consideration must be given to the two other common causes of low air pressure.

A measure of the adequacy of piping is the pressure loss between the air receiver, where the compressor endeavors to maintain a constant pressure, and the point of use. This should not exceed 10 per cent in a well designed system. The maximum drop for the worst point in the system should not exceed 15 per cent. If the pressure drop is greater, attention should be given to correction of this fault before increasing the capacity.

If leakage is eliminated, the compressed air formerly wasted will be available for useful work. The expense of making lines tight will undoubtedly be less than the installed cost of a new compressor, while the daily power saving may be considerable. Elimination of leakage is certainly an important step toward maintaining air pressure and conserving power.

Effects of Low Air Pressure

There are very few uses of compressed air not vitally influenced by low air pressure. All portable pneumatic tools, hoists, scrapers, loaders, pneumatic transfer and conveyor systems, paint sprays, oil burners, sandblasts, air-lift pumps, etc., operate less effectively when the proper air pressure is not maintained. The results of increasing air pressure to the proper value are greater production and reduced cost per unit produced.

The economic advantages of increased air pressure (or conversely, the losses due to low pressure) can be illustrated by considering portable pneumatic tools. For example, an average increase of 37 per cent in production can be obtained for about 30 per cent increase in air consumption, or by increasing the air pressure at the tools from 70 to 90 pounds.

Consider an installation of twenty grinders operating from an $8500 compressor system, first at 70-pound gage and then at 90-pound gage. The following tabulation gives an idea of the relative costs and productivity.

Operating air pressure at tools, pounds	70	90
Tool load factor, per cent	33	33
Cubic feet per minute of air required per tool at maximum load	50	68
Total cubic feet per minute of air used	333	453
Total cubic feet of air used per eight-hour day	160,000	217,600
Cost of air per 1000 cubic feet	$0.05	$0.05
Cost of air per day	$8	$10.88
Increased air cost		$2.88
Total labor cost per day	$320	$320
Total cost per day	$328	$330.88
Ratio of air cost to total cost, per cent	2.4	3.3

Assuming that only one-third of the 37 per cent increase in tool productivity can be translated into labor productivity, it is evident that 12 per cent more metal will be removed with 90-pound gage air pressure than with 70-pound

in a Compressed-Air System

gage air pressure. The work previously done for $328 can now be done in less time, and the cost will be $330.88 divided by 1.12, or $295.43. Thus, even though air costs are increased, there is a net saving of $32.57 per day, or nearly $8500 per year—the equivalent of the first cost of the compressor plant.

Analyzing this another way, when the pressure is increased to 90-pound gage, the tools require 120 cubic feet per minute more air. A compressor with motor and auxiliary equipment to supply about this amount of air would cost $2200. The saving of $32.57 per day would pay for this new unit in approximately sixty-eight working days.

Remedies for Low Air Pressure

The remedies for low air pressure are just as definite as the causes and effects. Faulty air-power conditions are usually due to poor planning or increased air uses without corresponding expansion of the system. Plant-wide analysis should determine the full extent of low air pressure and the present air flow requirements. Future growth must also be considered.

Pressure loss varies roughly as the square of the velocity of air flowing through the pipe. For example, a 3-inch line, 1000 feet long, will pass 500 cubic feet per minute with a 2.5 pound pressure loss, while a 4-inch line will pass about 1000 cubic feet per minute with the same drop. The installed cost of the 4-inch line will, however, be very little more than that of the 3-inch line, since most of the cost is for labor.

Methods of increasing pipe-line capacity to decrease pressure loss and improve conditions at the point of use vary with different installations. One may call for a line paralleling the original, with frequent interconnections; another may require installation of a loop system with some outlets taken off the new line to relieve the old; still another may need a complete new system. Branch lines and manifolds for attachment of tools, etc., should be made over-size.

Not the least of the problems of correct system lay-out is the selection of the proper hose for final transmission of compressed air to the tool. Losses of 15 to 25 per cent in air pressure are frequent in the hose alone. The length of the hose should not be greater than is necessary to make the tool available to the work and to give proper freedom of movement to the operator.

Every cubic foot of air leakage eliminated is pure gain. Such losses in many systems will reach 10 to 20 per cent of the total air compressed. An air leakage test should be run on the complete system and every section of hose should be inspected. Although leaks are usually small, they may be numerous, having a high total effect. A single 1/16-inch hole will waste 182,000 cubic feet per month, costing $9.10.

The most likely locations of small leaks are around valve stems, in hose connections, unions, drains, homemade blow-guns, and lines leading to inoperative tools. Regular inspection is mandatory. Only after it has been determined that the distribution system is adequate and that leakage has been eliminated should increase in compressor capacity be considered.

* * *

Lincoln Annual Engineering Undergraduate Welding Award

The James F. Lincoln Arc Welding Foundation has announced the 1947 Annual Engineering Undergraduate Award and Scholarship Program. This program, started in 1942, was interrupted by the war, and is now being resumed. The program consists of two independent plans—the Award Plan and the Scholarship Plan. Under the Award Plan, students of various engineering schools and colleges may submit papers on arc-welded design and the use of welding in the maintenance of machines and structures. A total of $6750 is offered in prizes, there being seventy-seven individual awards ranging from $25 to $1000 each.

Under the Scholarship Plan, scholarships will be allocated to the schools in which the three highest award recipients are registered. These institutions will receive amounts of money, equal, respectively, to those awards, to be used for scholarships in the departments in which the award students are registered. Papers submitted must be postmarked not later than May 15, 1948. Copies of the rules and conditions can be obtained by writing to the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

* * *

The automotive industry is aiming to produce 4,700,000 vehicles this year. In 1929—the peak production year—5,360,000 vehicles were made.

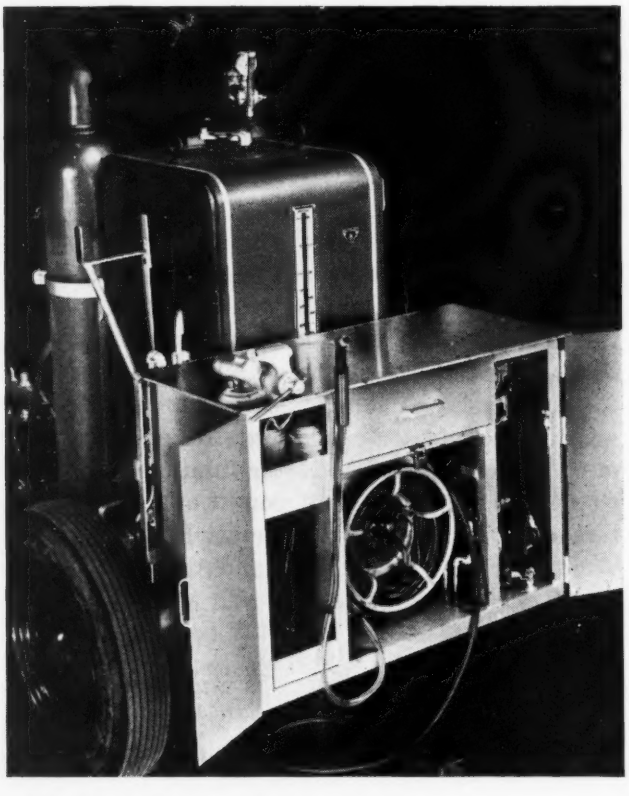
Engineering News

Portable Welder for Inert Gas Welding of Aluminum

A portable welder in which is incorporated all of the equipment necessary for inert gas welding of aluminum has been designed by the Aluminum Co. of America. While built specifically for joining electrical conductors during plant construction and assembly, it can also be used to join aluminum tubes, extruded sections, and sheets up to 1/4 inch thick.

The inert gas metal arc process was selected for making these joints because no welding flux is needed. This process consists of drawing an alternating-current arc between a tungsten electrode and the aluminum to be welded. The electrode and the molten aluminum are protected from oxidation by an envelope of argon gas, which is inert to both materials and practically insoluble in aluminum. The high heat intensity of the electric arc permits the joints to be made quickly, and with a minimum amount of heat. Both the welding torch and its power cable are water-cooled.

The unit shown in the accompanying illustration requires a power source of about 20 K.V.A. 440- or 220-volt, 60-cycle current, and a supply of clear, cool water at the rate of 1/2 a gallon a minute with a pressure of 50 pounds per square inch.



The Portable Welder Illustrated Here, Built by the Aluminum Co. of America for Inert Gas Welding of Electrical Conductors, Can also be Used to Join Aluminum Tubes, Extruded Sections, and Sheets up to 1/4 Inch Thick

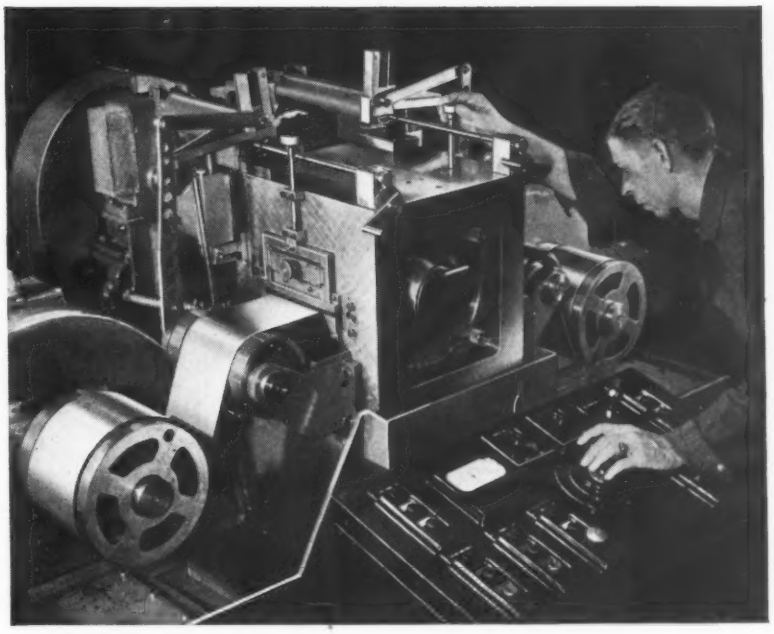
New Coal-Burning, Steam-Turbine Electric Locomotive

One of the exhibits that attracted attention at the Railroad Show, recently held in Atlantic City, was a 6000-H.P. steam-turbine electric locomotive, the first of a new coal-burning type built by the Baldwin Locomotive Works. Locomotive and tender together weigh almost 600 tons and have a length of 150 feet.

This is America's first non-condensing steam-electric locomotive, and is one of three such motive power units to be built by Baldwin for high-speed passenger service on the lines of the Chesapeake & Ohio Railway. The new locomotive is a coal-burning type, combining in one self-contained motive-power unit the principles of the conventional steam locomotive boiler, the steam turbine, and the electric drive. A Westinghouse turbine transforms the heat energy of coal and steam into 6000 H.P., which the generators convert into 4000 kilowatts of electricity to drive the traction motors geared to the axles.

Carbide-Blade Mining Tool for Drilling Hard Rock Formations

Development of a mine tool which may make possible the profitable working of mines hitherto uneconomical to work because of hard rock formations has been announced by the Carboloy Company, Inc., Detroit, Mich. Developed cooperatively with the Ingersoll-Rand Co., this percussion type detachable drill bit set with cemented-carbide inserts enables even the hardest rock formations to be drilled at speeds heretofore found impossible. No changes in equipment are necessary. The drill bit is completely interchangeable with the latest stud type steel four-point jack-bits.



Rolling Magnetic Alloy Sheet in a Miniature Cold Strip Mill at the Westinghouse Research Laboratories. One Hundred Foot Lengths, 1/40 Inch Thick, are Reduced to Strips a Mile Long and 1/2000 Inch Thick

Miniature Rolling Mill Aids Metal Research

A miniature Sendzimir rolling mill, capable of reducing alloy sheet from 1/40 to 1/2000 inch in thickness, is being used by the Westinghouse Research Laboratories to roll "Hiperco"—an electrical alloy—for experimental use. Designed by the Armzen Co. of Middletown, Ohio, the mill stands less than the height of a man and is about as wide as an office desk. The two rolls that do the work measure less than half an inch in diameter, and yet give forty times more compression than would the larger rolls of ordinary mills. Each part of the delicately balanced roll mechanism is ground to an accuracy of 0.0001 inch.

In operation, a 100-foot length of metal strip is fed into the mill at speeds up to 200 feet per minute. The material is wound on 12-inch reels on each side of the working rolls, and is passed back and forth seven times before it reaches the desired 1/2000 of an inch thickness, when it is then approximately a mile long.

Cushioning Capacity of Cellular Rubber Demonstrated

Eggs, recently dropped from the roof of a hospital building eleven stories high in New York, landed without breaking on a pad of spongelike rubber containing millions of tiny shock-absorbing cells. Those hitting the rubber target bounced back into the air—in some cases as much as 25 feet. The rubber, known as soft cellular rubber, is a development of the United States Rubber Co. The specimen used in the test was 3 inches thick. The demonstration took place before a group of scientists who are studying the mechanical factors that cause injuries in aviation accidents.

Cellular rubber has been used in the past as an insulator for refrigerators and as a buoyant material for life-saving equipment. It is not to be confused with sponge rubber, which it resembles in feel and appearance. Cellular rubber is lighter than cork, and is moisture-proof. It derives its cushioning capacity from microscopic cells—250,000 per cubic inch—filled with nitrogen. These tiny cells allow the material to conform immediately to the shape of the object thrown against it, giving support, and at the same time exerting pressures that offset the effects of a heavy blow. The air in sponge rubber escapes when a blow is delivered to it, but in cellular rubber the gas is trapped in each cell.

Station for Static Testing of Rocket Propulsion Motors

The first station for the static testing of rocket propulsion motors in sizes up to 50,000 pounds thrust has been constructed near Schenectady, and already has contributed invaluable data for basic rocket motor design and fuel development.

The station is part of a long-range developmental program undertaken jointly by the General Electric Co. and the U. S. Army Ordnance Department. It consists of three static test pits, each of which is divided into four rooms—a control room, a motor room, and two reactant rooms. The rocket motors are supplied with liquid oxygen and alcohol from the reactant rooms.

During a run, observations are made through windows or ports in a three-foot wall separating the control room and the motor room. Bolted to the floor opposite the observation ports are mirrors that reflect the motor and its exhaust to the observers, and on the wall above the ports is a camera which is operated from the control room and which photographs the rocket exhaust. Such factors as fuel consumption and thrust are, of course, recorded during the run.

The Twenty-Ninth National Metal Congress and Exposition

CHICAGO, OCTOBER 18 TO 24

THE twenty-ninth annual National Metal Congress and Exposition, sponsored by the American Society for Metals, will be held at the International Amphitheater, Chicago, Ill., for seven days beginning Saturday, October 18, and continuing through Friday, October 24. Approximately 375 companies and organizations will display and operate metal-working equipment and other products. The exhibits will occupy all the available floor space on both levels of the Amphitheater—about 240,000 square feet.

During the first five days, the exposition will be open from 12 noon to 10:30 P.M. On October 23 and 24, the hours will be from 10 A.M. to 6 P.M. Attendance on the two opening days will be by invitation.

As in the past, the National Metal Congress will combine technical sessions of the American Society for Metals, the American Welding Society, the Iron and Steel and the Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers, and the American Industrial Radium and X-Ray Society.

Morning sessions of the American Society for Metals will be held in the Palmer House, and afternoon sessions at the International Amphitheater. Heat-treating will be the principal subject at these sessions, discussions ranging from theoretical studies of phase transformation to practical applications of induction hardening. High-temperature alloys, metal properties at both high and low temperatures, steel-making problems, light metals and other non-ferrous alloys, metal-working, and testing will also be considered. Participants in a discussion "Metallurgical Requirements of the Atomic Energy Program" will include scientists on the staff of the U. S. Atomic Energy Commission.

The American Welding Society will present a total of seventy papers, covering sixteen classifications of welding application and research, during twenty technical sessions.

The technical sessions of the Metals Divisions of the American Institute of Mining and Metallurgical Engineers will be held on October 20 to 22, inclusive. The headquarters of this Society will be at the Stevens Hotel. The sessions of the American Industrial Radium and X-Ray Society will be held on October 22 to 24. Leslie M. Ball, of the Naval Ordnance Laboratory, Washington, D. C., will deliver the Lester Lecture.

The Industrial Gas Breakfast, sponsored by the American Gas Association, will be held on October 22 at the Stevens Hotel. This Association will also sponsor a combined industrial gas exhibit at the exposition, in which twelve companies will participate.

Cutting Corrosion-Resistant Alloys by the "Flux-Injection" Method

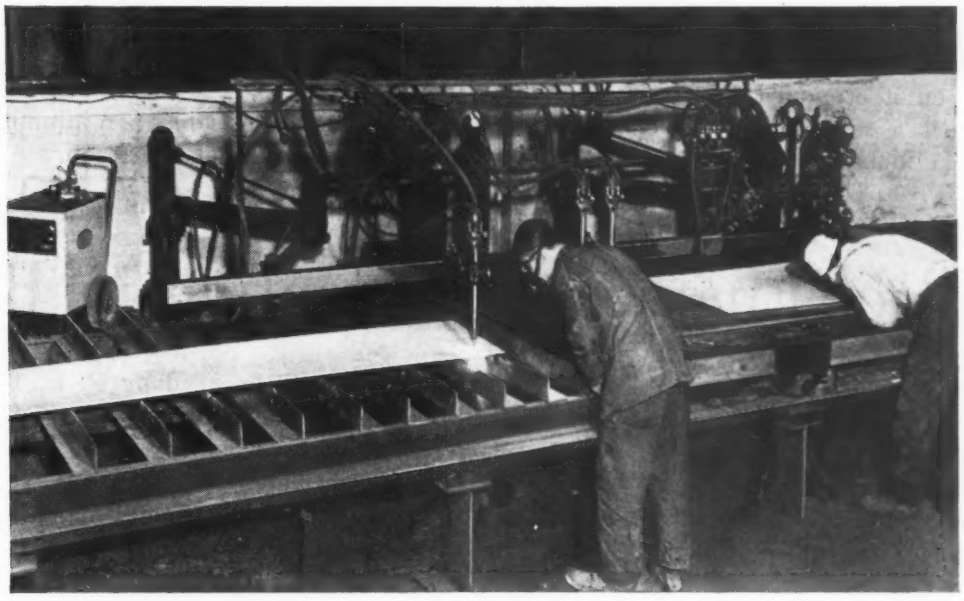


Fig. 1. With a Standard Oxygraph and Special Flux-feeding Unit, Vanes are Cut by the "Flux-Injection" Method from 3/8-inch Stainless Steel

FABRICATION of stainless steels by a combination of flame-cutting and welding has been made possible through the introduction of the "Flux-Injection" method of flame-cutting stainless steel recently developed by the Air Reduction Co., New York City. With this method, a special dry non-metallic flux is carried directly by the cutting oxygen stream to cope with the refractory oxides formed by the alloy elements. This flux-bearing oxygen emerges through a standard style tip to effect the cut, the only special equipment required being a portable flux feed unit. Speeds, costs, and quality are comparable with similar operations on mild steel.

An interesting example of this type of fabrication was the construction of a 12-foot diameter

Fig. 2. Internal View of a "Hydrapulper" Machine, the Base of which was Welded from Nickel-clad and Stainless-steel Parts Flame-cut by the "Flux-Injection" Method

steel base for a Dilts "Hydrapulper" at Smith & Caffrey Co., Syracuse, N. Y. This machine is used to reduce pulp and reclaimed paper to a slush form suitable for paper-making machines.

"Flux-Injection" cutting was used for both the nickel-clad and chromium-nickel stainless steels used in this base. The most important stainless parts were the vanes. They were quickly cut to finish dimensions from 3/8-inch thick stainless-steel plates on a standard Oxygraph machine equipped with a manual tracing head fed at the rate of 11 inches per minute. Average cutting time per piece was less than two minutes.

In ordinary oxy-acetylene practice on nickel-clad material, the cut would proceed from the mild steel side, with considerable risk of separating or melting away the cladding. With the "Flux-Injection" method, the cut was made from the nickel side. The cladding remained intact, and the resulting edge was in excellent condition for welding. The finished machine, shown being inspected in Fig. 2, is corrosion-proof, abrasion-resistant, rigid, and has a minimum number of parts to loosen under vibration.

The Tool Engineers Convention in Boston

THE theme of the three-day semi-annual convention of the American Society of Tool Engineers, which will be held at the Hotel Statler, Boston, Mass., on October 30 to November 1, inclusive, will be: "More efficient machine tools will lead to a sounder economy." The first technical session, on Thursday afternoon, October 30, will be devoted to the subject "A New Concept in the Field of Abrasives—32 Alundum." Three representatives of the Norton Co. —W. T. Montague, vice-president and manager, business planning and development; A. A. Klein, assistant director of research; and G. T. Rideout, sales manager—will participate in this program. In the evening session, E. Girardot, foreman of the tool design section, General Electric Co., Schenectady, N. Y., will present a paper entitled "Welding as Applied to the Construction of Tools, Dies, Jigs, and Fixtures." D. W. Puffer of the welding section, General Electric River Works, Lynn, Mass., will also take part in this program.

At the afternoon session on October 31 material handling will be discussed. The keynote address "Economics of Good Material Handling Equipment" will be made by Edward W. Burnell, vice-president, Link-Belt Co. A paper on "Material Handling through Heat Processes and Monofilament Material Handling" will be presented by C. A. Litzler, president, Industrial Ovens, Inc.; and Thomas N. Parlon, associate director of field activities of the Yale & Towne Mfg. Co., will read a paper on the subject "Production is Material on the Move."

The Friday evening meeting will be devoted to bearing applications, and E. W. Miller, vice-president and general manager of the Fellows Gear Shaper Co., will give the keynote talk. Papers entitled "Bearing Selection" and "Plain Bearings" will be read by F. E. Ericson, vice-president, Barden Corporation, and Lewis Sandler, executive vice-president, Johnson Bronze Co., respectively.

There will be a Saturday morning session on the professional development of the tool engineer, at which Dr. William T. Alexander, Dean of Engineering at Northeastern University, Boston, will speak on the subject "The Tool Engineer and America's Future Defense." At the final technical session on Saturday afternoon, the following papers will be presented: "Tooling for Electric Clocks," by Harry B. Whitehead, general superintendent, Telechron, Inc.; "Tooling for a Fine Watch," by E. W. Drescher, superintendent of product engineering, Hamilton Watch Co.; and "Mass Production of Watches and Clocks," by Roger M. Tarpy, managing director, Vulcan New England Co.

Mornings will be devoted to tours of many manufacturing plants in Boston and nearby cities.

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Index to A.S.T.M. Standards

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., announces the publication of "Index to A.S.T.M. Standards," which covers 1400 standard specifications and tests. This index enables anyone to locate any particular specification or test in the 1946 Book of Standards of the Society, and is also of service to those who wish to determine whether the Society has issued standard specifications, test methods, or definitions on a certain engineering material or subject. The material is classified both by subject and numerically. Copies can be obtained without charge from the Society.

Stress Distribution in Punch Presses Analyzed with Electric Strain Gages

TO obtain a comprehensive analysis of the stress distribution in its 30-ton punch presses, the Diamond Machine Tool Co., Los Angeles, Calif., recently applied electric strain gages to approximately two hundred different locations on the frame, tie-rods, and cross-members of a press. As a result, the weakest section of the frame was located and modified, and the breaking strength of the press was increased from 108 to 166 tons.

A conventional type of strain gage was employed in the tests. It consisted of several loops of high-resistance wire, cemented to the press and connected through an electric supply source to a galvanometer. In some cases, the strain gages were used singly to record strain in one direction only; in others, they were mounted in a triangular pattern—termed "rosettes"—to measure secondary stresses, as well as strains in several directions. Both types of gages are shown in Fig. 1.

After the circuit was balanced with a Wheatstone bridge, the press was loaded; as the frame was distorted, so was the wire, thus altering its cross-section and changing its electrical resistance. These minute changes were read directly on the galvanometer. The press was loaded by a 50-ton mechanical jack, which was placed on the bed. The ram was engaged so that the jack loaded the press frame in a manner similar to actual operation, and the jack tonnage was determined from strain gages affixed to opposite sides of the connecting-rod. Strain records were made at various jack tonnages, some with the tie-rods tight and others with the rods loose. Two dial indicators on either side of the jack on the ram-center line were used to observe the opening of the press throat as a function of tonnage. To check the accuracy of the strain gages used on this static test, the connecting-rod was removed and calibrated on a 100,000 pound Tate-Emery testing machine.

Certain illuminating and unexpected discoveries resulted from the first static test on the frame. For example, in making the test, it was found that the 1/4-inch radius fillets at the juncture of the side frames and bed were subjected to a very high stress. As an experiment, the fillets were machined to a 3/4-inch radius, as shown in Fig. 2, on the assumption that a larger fillet would result in less stress concentration, and that the small amount of metal removed

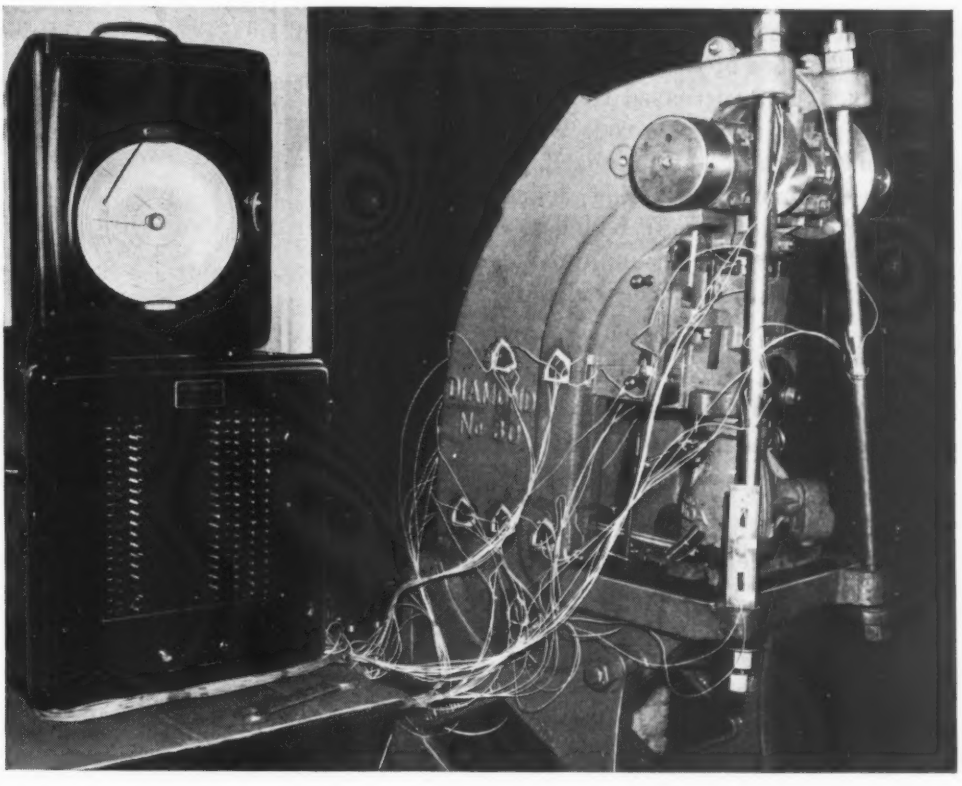


Fig. 1. Strain Gages and "Rosettes" were Cemented to the Frame of a Diamond 30-ton Punch Press and Connected to the Strain-gage Recorder during Tests with Static Loads

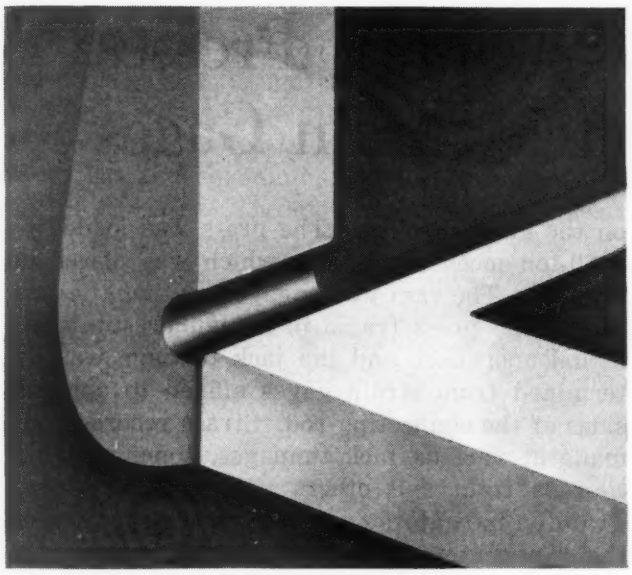


Fig. 2. An Enlarged 3/4-inch Platen Fillet Area at the Juncture of the Side Frames and Bed was Adopted as the Result of Static Tests. This Larger Fillet Reduced Strain by 38 Per Cent

would not decrease the rigidity of the frame or appreciably increase the average stress in the cross-section.

This assumption proved correct. For the 1/4-inch fillet radius, the strain at 30 tons was 0.00175 inch per inch, while the corresponding strain with a 3/4-inch fillet radius was 0.00108 inch per inch, representing a strain reduction of 38 per cent. Static testing proved that, by removing metal at the fillets, the frame was actually strengthened.

Another fact brought to light by static testing was that the use of tie-rods reduced fillet stresses 80 per cent and increased frame stiffness 74 per cent. As long as the tie-rods were in slight tension, full advantage was realized. The tie-rods, by almost eliminating rotating deflection (springing open of the frame) which is common with C-type frame construction, and by insuring better alignment, also increase die life.

* * *

Brazing Three-Piece Assembly with Induction Heating Unit

The induction heating equipment shown in the accompanying illustration is being used in an unusual and interesting manner by the Reading Hardware Co., Reading, Pa., for joining three assembled parts of a lawn mower—the spider, drive-shaft, and bearing retainer. The brazing operation is performed quickly and in such a manner that the alignment of the assembled parts is held to close tolerances.

The parts come to the brazing station cleaned and ready for assembly. A girl assembler first places four spiders in a ceramic fixture and brushes the center hole of each with "Handy Flux." A piece of "Easy-Flo" brazing alloy wire, 3/64 inch in diameter, which is formed into a ring having an inside diameter of 5/8 inch is next slipped on the drive-shaft. The end of the shaft and the brazing alloy ring are then liberally brushed with flux. A bearing retainer is now placed over the shaft end, after which the two parts are assembled on the spider. The fixture with four of these complete assemblies is then made ready for the heating operation.

An induction heating unit with two brazing stations is used. This unit is equipped with jigs for aligning and maintaining close tolerances between the parts, especially between the drive-shaft and the bearing retainer. The fixture holding the four assemblies is placed over the heating coils, all heating being done from the bottom or below the fixture—the method that was found to be most practical after a period of considerable experimenting.

The heating coils do not interfere with the operation of the jigs, which are lowered over the parts while heating. Heat can be concentrated on the heavier parts—the drive-shaft and the spider—thus preventing warping in the lighter gage bearing retainer. With this heating arrangement, the brazing alloy is drawn through the joint, causing the parts to be bonded together accurately and firmly. Four assemblies are brazed at one time in about thirty seconds, or an average of seven and one-half seconds each.

Three-piece Lawn-mower Roller Assembly and Induction Heating Unit Employed for Silver-alloy Brazing Operation

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Brazing Flux	**All-State No. 31-A**	An aluminum flux that melts at about 950 degrees F. and becomes quite active at 1000 degrees F. Gives excellent capillary action to aluminum brazing alloy.	For brazing sheet aluminum.
Permanent-magnet Material	**Alnico 12**	An alloy of aluminum, nickel, cobalt, iron, and titanium. These magnets are cast and must be ground to shape.	Magnets of this material can be used in such applications as tachometer generators and electronic devices.
Soldering, Brazing, and Welding Flux	**Amco No. 4015**	An aluminum soldering, brazing, or gas welding flux that can be used with aluminum solders or with ordinary 50-50 tin-lead solder. It has a relatively low melting point and retains its activity over a wide temperature range.	For use in brazing or welding rolled or cast aluminum. Can be employed for soldering, brazing, or welding aluminum to iron or steel and to brass, copper, Inconel, Monel, aluminum, bronze, and other alloys.
Copper Castings	**Ampcoloy 90**	Copper castings with guaranteed electrical conductivity of 90 per cent minimum. Values ranging up to 98 per cent have been obtained.	Useful for making electrode-holders for arc furnaces, electrical contacts, and castings for resistance welding machines.
Fog-preventing Compound	**Anti-Fog**	A compound that prevents fog, mist, or steam from forming on glass or plastic surfaces.	Suitable for treating goggles, gas masks, and safety shields.
Packing Liner Fabric	**Aquastop**	A tough, flexible, and resilient waterproof packing liner fabric made of impregnated and coated synthetic material. Although fully waterproof, passage of moisture vapor is permitted, tending to prevent condensation within the package due to temperature changes.	Used as liner in wooden shipping boxes to make package waterproof.
Internal Plating Process	**Bart Lectro-Clad**	A process that develops a smooth, ductile, pore-free nickel deposit, fully adherent to the base metal. Internally plated pipe can be welded, reduced, and bent (hot or cold) without destroying the lining.	For application to inside of steel pipe or tubing up to 18 inches in diameter with lengths up to approximately 20 feet.
Thermosetting Plastic	**BCM**	A thermosetting plastic resin with excellent bonding properties and high resistance to heat. Used with various reinforcing materials, such as glass fabric, to form laminates.	Is being tested for use in tooling jigs and for structural panels in automobiles, airplanes, refrigerators, and washing machines.
Non-pigmented Lubricant	**Beacon No. 103**	A drawing compound that can be readily removed from any work-piece to be enameled or bonderized, regardless of time elapsed between die work and finishing. It contains no mineral oils.	For application by brushing or dipping to parts to be drawn.
Chain Lubricant	**Botlube**	A non-staining, soapless, non-corrosive lubricant that contains no oil. It has a high degree of wetting action and forms a thin but exceptionally durable film.	For lubricating high-speed chain conveyors.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Corrosion Inhibitor	**Brass Lyfe**	Brass and copper alloy corrosion inhibitor, furnished as a 10 per cent solution of the active organic chemical in butyl cellosolve. Is mixable with oils, lubricants, and lacquers. Completely stops corrosion of copper-containing alloys, whether due to oxygen, organic acids, or amines.	Specifically intended for copper and copper alloys; not effective on any other metals. Can be used in drawing compounds and soluble oils.
Tubing	**Callite Tungsten**	A seamless molybdenum tubing in sizes ranging from 0.040 to 0.500 inch outside diameter and in lengths up to 9 inches. Can be readily machined, shaped, and welded.	Particularly suitable where resistance to hydrofluoric acid, potassium, or sodium hydroxide is needed.
Ground Flat Stock	**Capewell**	A precision-ground flat steel stock manufactured from electric furnace steel and annealed for easy machining. Hardnesses up to 66 Rockwell C can be obtained by proper heat-treating.	Wherever flat steel stock is called for.
Rust Inhibitors	**Carbo C** **Carbo N**	Two specialized types of rust inhibitors. Carbo C is inactive on all metals and alloys, including magnesium and aluminum. Carbo N has no effect on iron, steel, or ferrous alloys, but has slight action on softer metals, such as lead, zinc, magnesium, and aluminum.	For temporary protection of metal parts and materials during inside storage. Can be used to prevent rust in lines through which salt solutions are drained from crude-oil storage tanks or tanks holding water and brine.
Light-weight Foamed Plastic	**Cellular Cellulose Acetate**	Combines insulation against heat and cold with unusual structural strength when bonded between two sheets of metal, wood, or plastic.	Can be bonded to such metals as aluminum, magnesium, steel, and stainless steel, as well as wood and plastics.
Chemical Finish for Aluminum	**Chemoxiding**	A chemical process for finishing aluminum and aluminum alloys. Lustrous and glossy finishes that are relatively hard and have high corrosion resistance are produced. Colorings range from light gray through marbleized to light brown, depending upon timing and alloy being treated.	Suitable as a finish in such applications as sheets, tubes, extruded parts, and rods after fabrication; in cases where inserts of steel, brass, or copper are present; where a good base for paints and lacquers is desired; when brazed aluminum assemblies must be processed; when polishing is not required or is too costly.
Cellulose Gum	**CMC**	A compound that greatly increases the viscosity of water and can be used to control the viscosity of any solution in which it is used. It is relatively non-hygroscopic, and is compatible with many water-soluble materials, such as gums, plasticizers, and resins. Also forms tough films and acts as emulsifying agent in oil and water emulsions, protecting the emulsion.	For controlling viscosity of solutions, protective purposes, and other special applications indicated by its properties.
Hard-facing Alloys	**Coated Stoody 1** **Coated Stoody 6**	Two hard-facing alloys having a special dipped coating to make applicaton easy with either alternating- or direct-current arc-welding equipment.	For application on all heavy equipment subject to heat, abrasion, corrosion, and impact, and for parts where oxy-acetylene hard-facing is impractical.
Iron and Steel Coloring Process	**Color Parkerizing**	A chemical immersion process that imparts colors to Parkerized iron and steel surfaces and also increases corrosion resistance. Can be applied to threaded or assembly parts.	Applicable to all Parkerized products; useful for identification of different springs, screws, etc.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Plastic Adhesive	**Cordo-Bond No. 250**	A plastic adhesive that bonds quickly by baking at 250 degrees F. under a pressure of 50 pounds per square inch. Shear strength of bonds ranges up to 2000 pounds per square inch.	For establishing strong, lasting laminations of metals, plastics, and woods in various combinations.
Rust Remover	**CorOdex**	A liquid rust remover that penetrates readily to reach pin-point spots, pits, crevices, cracks, or corners.	Application is by swabbing or dipping. Effective on any metal surface.
Permanent-magnet Material	**Cunico**	An alloy of copper, nickel, and cobalt that is malleable, ductile, and machinable. Magnets are furnished only in final shapes, as they are age-hardened in the manufacturing process.	Used for the manufacture of small magnet screws and the punching of intricate magnet shapes.
Permanent-magnet Material	**Cunife**	A copper-nickel-iron alloy having the physical properties of Cunico; must be magnetized only along direction of cold-working to obtain highest magnetic quality.	A wide variety of magnet designs can be obtained by forming, punching, or machining to shape.
Silicone Greases	**DC 31** **DC 33** **DC 41** **DC 44**	Four silicone greases developed to meet the need for high- and low-temperature bearing lubrication. DC 31 is an almost completely inorganic grease serviceable at temperatures as low as minus 95 degrees F. Has satisfactory lubricating life at temperatures up to 300 degrees F. Is water-resistant under any service conditions and also resistant to oxidation by air or ozone. DC 33 is a silicone grease thickened with metallic soaps. Is serviceable over a temperature range of minus 95 to 300 degrees F. Its water resistance is comparable to that of calcium- or lithium-based petroleum greases. DC 41 does not melt at temperatures in excess of 480 degrees F. Is also serviceable at temperatures as low as minus 4 degrees F. It is waterproof and resistant to oxidation by air or ozone. DC 44 is serviceable at temperatures as low as minus 4 degrees F., and has a water resistance comparable to that of calcium- or lithium-based petroleum greases.	DC 31 is for low-temperature lubrication at operating speeds of less than 4000 R.P.M. DC 33 is for low-temperature lubrication of bearings operating at speeds up to 10.000 R.P.M. DC 41 is for lubrication of bearings operating at elevated temperatures and at speeds of less than 4000 R.P.M. DC 44 is for high-temperature lubrication of bearings operating at speeds up to 10,000 R.P.M.
Silicone Resin	**DC 804**	A thermosetting silicone resin which can be used in formulating paints having exceptionally high heat and moisture resistance and a hard mar-resistant surface. Also has high resistance to oxidation, ozone, and ultra-violet radiation.	Especially suitable for producing white finishes having properties between those of ceramic coatings and ordinary organic paints.
Silicone Varnish	**DC 996**	Inorganic silicone compound that cures at 300 degrees F. Provides greater protection against failure due to sustained overloads; greatly increased service life of electrical insulation; and higher permissible operating and ambient temperatures.	For impregnating windings of electrical equipment.
Silicone Compound	**DC Antifoam A**	A compound that prevents foaming in chemical processes and industrial operations.	May be used to eliminate or reduce foaming of various aqueous solutions, even when subjected to steam distillation or vacuum concentration.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Silicone Mold Compounds	**DC Mold Release Fluid** **DC 7 Compound**	Silicone mold release agents which act as lubricants, reducing friction between dies and plastic materials, improving plastic flow, reducing surface striation, and affording easy release from the mold or from rubber bags use in low-pressure laminating.	For use in molding rubber and plastic materials. DC Mold Release Fluid has been especially effective in injection molding of various plastic materials.
High-density Alloy	**Dense Alloy No. 112**	An alloy composed largely of tungsten, with some cobalt, nickel, silver, and copper added. Has a density of about 0.620 pound per cubic inch (about one and one-half times that of lead). It is readily machinable, and can be brazed or soldered by standard methods.	Has been used in balancing weights where space is of prime importance.
High-speed Steel	**Desegatized Steel**	High-speed steel formed by a process that prevents segregation of free carbides in brittle mass near center of high-speed steel bars. Shows longer tool life, longer run between grinds, minimum warpage and breakage, and more consistent tool performance.	For use in high-speed tools and other applications common to high-speed steel.
Packaging Compound	**Dipwrap**	Hot dip compound that provides a tough, resilient coating for protecting machined surfaces and cutting edges. Coating is impervious to air and moisture, and prevents rust and corrosion. It can readily be removed by peeling.	For protection of metal products during shipment and storage.
Diaphragm Cloth	**DL-011**	An 80/80 base diaphragm cloth with good mechanical strength and flexibility that is practically unaffected by relatively wide temperature changes.	Developed primarily for automotive use, but recommended for applications where strength, flexibility, and temperature resistance are important.
Water-repellent Material	**Dri-Film**	A water-repellent material which forms a continuous insulating film over glass.	Fluorescent lamps, even with metal reflectors, when coated, are practically insensitive to high humidity. Also used for treating ceramic radio insulators.
Tool Steel	**Dunkirk EZ**	Free-machining steel that hardens to about 65 Rockwell C when oil-quenched from 1450 to 1550 degrees F. Can be tempered up to 500 degrees F. without softening below 60 Rockwell C. Has high impact and transverse rupture strengths and an unusual resistance to wear and abrasion.	Specially intended for machined tool-steel parts such as dies, gages, forming rolls, bushings, liners, and bodies for multiple-edge tipped tools.
Insulating Board	**Durok**	A 100 per cent non-cotton cellulose electrical insulating board having characteristics superior to 100 per cent rag board. Also has good heat aging characteristics. Dries readily, and absorbs insulating varnish.	For applications requiring electrical insulating board.
Silver Brazing Alloys	**Easy-Flo 35** **Easy-Flo 45**	Silver brazing alloys featuring low silver content. Easy-Flo 35, containing 35 per cent silver, has a melting range of from 1115 to 1295 degrees F., and is free flowing at an exceptionally low temperature for its silver alloy content. Easy-Flo 45 has a melting range of 1120 to 1145 degrees F.	Easy-Flo 35 is suitable for producing joints between ferrous or non-ferrous metals which are high in strength and ductility. Easy-Flo 45 is particularly applicable where a lower working temperature range is called for.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Solvent Cleaner	**EC-75**	An emulsifiable solvent cleaner that will not harm alkaline cleaners. As a penetrating solvent, it is used undiluted to replace naphtha, kerosene, and chlorinated solvents.	Suitable for removing oil, buffing compounds, and other organic dirt, as well as solid dirt, from all types of metals.
Chrome-vanadium Steel	**Elastuf Type A-2**	Special chrome-vanadium steel containing small controlled amounts of nickel and molybdenum, which is commercially machinable. Tensile strength, 125,000 to 160,000 pounds per square inch; yield point, 100,000 to 145,000 pounds per square inch; and Brinell hardness 262 to 341.	Suitable for use where high strength and resistance to impact, fatigue, wear, shear, and compression are called for. Also adapted to high-temperature use.
Drill Lubricant	**Elf**	Lubricant with paraffin wax base, packaged so that application is by running the drill through a cardboard container. Increases drill life by reducing breakage; prolongs sharpness; and decreases operating temperatures.	For application as a drill lubricant.
Aluminum Brazing Flux	**Elite**	Properties that make possible the use of Airco No. 26 welding wire for brazing 2S, 3S, 53S, and 61S aluminum.	For aluminum brazing.
Plastic Packaging Compound	**Eronel Thermodip**	Plastic dip that coats metal products with a tough, transparent, flexible skin which can be readily peeled off.	For protecting metal parts or products during shipment or storage.
Synthetic Adhesive	**Fairprene No. 5118**	A thermoplastic synthetic elastic composition that does not require vulcanization to obtain maximum adhesive strength. Is weakened only slightly by oils or straight gasoline. Is unaffected by temperatures as low as 40 degrees F., but is weakened at temperatures of 160 degrees F. and above. Full bond strength is regained after cooling.	Recommended for bonding Buna-N type synthetic rubbers and vinyl films or sheet stocks to rigid surfaces, such as steel, aluminum, glass, wood, or concrete.
Cleaning Compound	**Ferrex**	A non-inflammable hot tank cleaner that effectively removes carbon and paint, as well as grime, grease, gums, heat-hardened resins, and heavy dirt.	For use on steel, cast iron, bronze, copper ,and red brass.
Plastic Tubing	**Fibron**	Flexible plastic tubing with unusual heat-resisting qualities, has ability to withstand varnish treatment and baking operations without stiffening.	For applications requiring resistance to strong acids and alkalies, denatured alcohol, petroleum and its products, and coal-tar solvents; also where high dielectric and tensile strengths are important.
Welding Flux	**Flo-Well No. 1**	An improved, free-flowing flux for gas welding that will not solidify or deteriorate.	Applicable to the gas welding of wrought, cast, or high-tensile aluminum and aluminum alloys of any size or shape.
Wire Solder	**Fluxrite**	A wire solder with flux in four closed grooves along the outside surface to insure a rapid even flow.	For general soldering operations.
Degreaser	**G-Bex D**	A neutral emulsifying solvent having a minimum flash point of 165 degrees F. Is not irritating to the skin, and is non-corrosive to all standard construction metals. Forms slight protective film after washing.	For light- or heavy-duty degreasing by spray, brush, or soak application followed by water rinse. Will hot-strip paint or lacquer.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Cleaning Solvent	**G-Sol 195**	Safety solvent that is characterized by high flash point and freedom from elements of toxicity and corrosion.	Useful for cleaning precision bearings, instrument parts, and similar mechanisms where both grease and oil gums are troublesome.
High-temperature Alloys	**Haynes Stellite Alloys Nos. 21, 23, 27, 30, 31, N-155, and N-153**	A series of alloys with high tensile and endurance strengths at temperatures up to 1500 to 1800 degrees F.	Developed originally for turbo-supercharger and gas-turbine applications.
Vinylite Finish	**High Solids Vinylite Finishes**	The resistance of Vinylite plastics and the adhesion, depth, gloss, and workability of synthetics are combined in this new series of finishes. They are adaptable to baking and produce brilliant finishes with a high degree of durability on interior and exterior surfaces.	Can be applied to both ferrous and non-ferrous metals by any method of metal product finishing, either before or after fabrication.
Cleaning Compounds	**Houghto-Clean 200 Series**	A series of seventeen different cleaning compounds, including cleaners for maintenance work and electrolytic and special-purpose compounds. New synthetic detergents have been utilized, as well as new alkalies that have become available as a result of wartime research.	For a wide range of ferrous and non-ferrous metal cleaning applications.
Infra-red and Ultra-violet Filter	**Infropake**	A plastic material that transmits approximately 84 per cent of visible light with practically no ultra-violet transmission between 200 and 400 milli microns and about 15 per cent infra-red transmission between 750 and 1500 milli-microns.	For use in industrial goggles and windows to protect eyes from harmful infra-red and ultra-violet radiations.
Chromate Coating Process	**Iridite Bright**	Applied by immersion in water solution after plating operation to provide protection against handling and tarnishing.	For application to zinc- or cadmium-plated parts.
Carburizing Process	**Karbo Kasing**	Liquid carburizing process that facilitates removal of all traces of salt from oil-quenched work.	Generally applicable where carburizing is called for.
Carbide Extruded Rounds	**Kennametal (in Extruded or Centerless-Ground Form)**	Rough extruded or centerless-ground rounds in two straight tungsten-carbide grades—KE5 and KE7—with Rockwell A hardness of 90.0 and 91.0, respectively.	Developed for use as wear-resistant elements such as guides, feeding fingers for automatic machines, rollers, guide rails, laps, scribers, points for engraving tools, thread checking wires, etc.
Cleaning Process	**Kolene**	Method of cleaning Meehanite bearing shells to produce a chemically clean surface with no free graphite particles. Makes possible use of lead arsenic babbitt.	Used to obtain a surface that gives an excellent bond between Meehanite shell and babbitt metal.
Plastic Coating	**Kotol**	Plastic coating that is tough, moisture-proof, and resistant to salt water. Retains flexibility at minus 40 degrees F. Has good aging characteristics at 180 degrees F.	For protection of machine parts during shipment and as a rack coating and stop-off lacquer for electroplating.
Cleaner	**K.P.**	Soapless cleaner that lathers instantly in hard, soft, or sea water.	Can be used effectively to clean grease-caked heavy machinery and to remove grease and grime from marine engines and cargo areas.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Dye for Plastics	**Kriegr-O-Dip**	A dye solution which can be obtained in a wide variety of colors; is applied by dipping.	Suitable for coloring polystyrene, acetate, Lucite, Plexiglas, and vinylite.
Thermosetting Plastic	**Kriston**	Thermosetting plastic having high optical and electrical properties, good resistance to abrasion, and high resistance to oils, greases, and most chemicals, including acids and alkalies. Forms a hard, heat-resistant plastic.	For use where optical properties are called for, in various electrical applications, and where resistance to abrasion is important.
Stainless-Clad Steels	**Lukens**	A complete line of stainless clad steels consisting of Type 304, 316, 347, 410, or 430 stainless steel bonded to a backing plate of carbon or low-alloy steel.	For customary stainless-steel applications requiring corrosion resistance and product protection.
Ceramic	**M-244**	Ceramic material having a thermal expansion coefficient in the same range as that of Invar (a nickel steel alloy employed in precision instruments and standard measures). It has high resistance to extreme thermal shock.	Suitable for high-temperature furnace construction; insulation for high-precision instruments in which dimensional changes must be minimized; and many other electrical and electronic purposes requiring low thermal expansion in ceramic parts.
Ground Flat Stock	**Marshall**	A ground flat carbon tool steel furnished in a form that practically eliminates cutting to size, shaping, planing, and finish-grinding. It is fully annealed for easy machining, and can be heat-treated by standard procedures.	Suitable for such products as templets, models, dies, jigs, shims, and gages.
Abrasive Disk Cement	**Master**	A cement with uniform high adhesive properties that helps to insure grinding accuracy.	For applying cloth-backed and flexible paper abrasive disks to steel-disk grinding machines.
Structural Material	**Metalite**	Structural material consisting of thin sheets of high-strength aluminum alloy bonded to a thick, low-density core of balsa wood. Also made with core material of greater density than balsa.	Can be applied where flat or curved surfaces are called for. Applications in many industries are indicated.
Corrosion Protective Compound	**Miccroloid**	Industrial maintenance coating compounded from thermoplastic resins which provides a tough, resilient, firmly adhering film that guards against severe corrosive conditions. Has most effective applications where a painted surface comes in continual contact with water or corrosive chemicals.	Applicable to plating equipment, acid and alkali rinse tanks, structural steel, factory walls and floors, pipe lines, air ducts, blower equipment, ventilating systems, process piping and tubing, water storage cases, water softening and refrigerating equipment, etc.
Plating Rack Coating	**Miccrotex**	Thermoplastic insulating electroplating rack coating that is air drying, tough, resilient, flexible, and unaffected by any solution commonly used in plating and anodizing cycles.	Meets all requirements of plating, anodizing, tannerizing, Parkerizing, and bonderizing cycles. Can be applied by dipping, brushing, or spraying.
Molding Alloy	**Moldaloy**	An alloy that melts at 430 degrees F.; has a hardness of 22 Brinell; a compressive strength of 8000 pounds per square inch; a tensile strength of 11,500 pounds per square inch; and a shrinkage of approximately 0.001 inch per inch.	Recommended for molds for casting low-temperature melting plastics; rubber molds; wax molds for precision casting; models for engraving machines; master patterns; forming dies for thin sheet metals and thermoplastics; proof casting of molds; and chuck jaws for holding irregular pieces.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Emulsifying Agent	**Mulsirex**	An emulsifying agent designed for use with kerosene and other petroleum cleaning agents to insure greater safety, efficiency, and economy. Its emulsifying characteristics make foreign substances readily soluble in water, facilitating cold-water rinsing after application of the cleaning agent.	Recommended for removing very heavy deposits of oil and light grease from all kinds of metal parts and equipment.
Industrial Adhesive	**No. 4665**	A tough, flexible adhesive that requires no catalyst or special preparation for use. Can be applied without thinning by brushing, roller coating, knife coating, or dipping. The dried film is resistant to dilute alkalies, acids, and corrosive salt solutions. Is also resistant to mildew and fungi.	Suitable for bonding metal foils and metal sheets to wood; plastics; vulcanized, synthetic, and natural rubber; as well as to other substances having widely different coefficients of thermal expansion.
Cutting-oil Bases	**Nopco 1009-C** **Nopco 1009-A** **Nopco 2009-A**	Nopco 1009-C is a cutting-oil base with high sulphur and chlorine content and a specially prepared fatty oil base. Odorless and free from tarry matter. Blends in all proportions with any diluent petroleum oil. Non-rusting and non-corrosive on ferrous metals. Nopco 1009-A is a sulphurized cutting-oil base containing 15 per cent sulphur in both chemical combination and active form. Is diluted or blended with low-viscosity mineral oil. Nopco 2009-A is a base soluble in all proportions in mineral oil.	Nopco 1009-C is recommended for steel-, brass-, and copper-cutting operations in which frictional loads are extremely high. Nopco 1009-A is recommended for straight cutting operations on ferrous metals. Nopco 2009-A is used for operations requiring rapid removal of frictional heat developed under high cutting loads. Also employed where strong detergent properties are needed to remove rapidly metallic dust during grinding, polishing, broaching, or similar operations.
Brazing Flux	**Nu-Braze Wonderflux No. 4**	Silver brazing flux that melts at 480 degrees F., well below oxidation temperatures of most metals, and forms protective coating. At 800 degrees F., it readily flows through clearances as small as 0.001 inch. Contains no free fluorides.	For general brazing applications. Particularly useful where brazing alloys are used in the form of powder.
Steam Cleaning Detergent	**Oakite No. 92**	A heavy-duty alkaline type detergent which gives thorough and fast steam-cleaning action at low concentrations. Prevents scale clogging in steam coils, is readily dissolved in hot water, and gives off no offensive fumes or toxic vapors.	For use in modern steam guns and coil type steam generating mechanisms. For cleaning machinery and equipment parts preparatory to repair and overhauling; preparing equipment surfaces for repainting and refinishing; cleaning equipment too large for tank immersion; and for paint stripping and other cleaning operations.
Cleaning Solvent	**Oakite No. 98**	Self-emulsifying, water-mixable solvent that is non-toxic and non-flammable in solution. Acts to prevent formation of water spots. Causes soil to float at top of cleaning tank.	For removal of light shop dirt and non-pigmented stamping compounds from steel and aluminum. Used primarily in pressure-spray washing machines.
Pickle Control	**Oakite Pickle Control No. 3**	Improves pickling cycle and results in less fuming, hydrogen embrittlement, pitting, and discoloration of work. Also minimizes frequency and cost of spent liquor disposal.	For use in inhibiting hot sulphuric-acid pickling solutions. Can also be used in mixed sulphuric-hydrochloric acid baths in which sulphuric acid predominates.
Floor Cleaner	**Optimus No. 1F10**	Floor cleaning compound for removing oil, grease, and dirt without harming the finish. Used in floor-scrubbing machines.	Suitable for use on cement, Terazzo, or tile floors.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Flux- and Scale-removing Compound	**Optimus No. 3**	Compound that can be used as a mild deoxident without serious etching of the surface of most metals. Flux and welding and brazing scale are removed in from five to fifteen minutes.	Applicable to welded steel tubing; brazed, hot-rolled, and cold-rolled steel; copper; brass; welded aluminum; cast iron; bronze castings; and most aluminum alloys.
Prepainting Solution	**Paint Bond**	A simple, fast, and economical method of preparing aluminum and its alloys for painting or lacquering.	Any alloy of aluminum can be so prepared by spraying, brushing, or dipping.
Metal Cleaners	**Pennsalt Cleaner A-22 and PM-95**	Pennsalt Cleaner A-22 is a general-purpose soak tank cleaner. PM-95 is an acid-base cleaning and descaling compound.	For cleaning aluminum before anodizing, chromodizing, phosphatizing, and other prepainting treatments, and before deoxidizing and subsequent spot-welding. For cleaning and descaling ferrous metals, especially for the removal of oxides resulting from heat-treating or annealing.
Rust-preventing Compound	**Pennsalt RI-50**	Inorganic salt mixture designed to protect ferrous metals for short periods. No rinsing is required before painting.	For use in water solution on ferrous metals before painting or enameling and between machine operations.
Protective Coating	**Phenoglaze**	A phenol-formaldehyde protective coating that provides a plastic film impervious to heat, moisture, and corrosive action.	Applicable to all types of wood and metal products.
Protective Coating	**Plastipak**	A coating that provides protection from moisture, acids, and alkalies. Forms a tough, elastic transparent or colored film. Adheres tenaciously, but is easily stripped off in a continuous sheet.	Has been applied successfully to cutting tools, gears, drills, taps, sheet metal, as well as to wood products, glass, and porcelain.
Synthetic Casting Resin	**Plastitool**	High-strength phenolic that is free from air bubbles after casting. It is hardened or cured by means of a catalyst and heat.	Specially adapted for plastic casting where trouble has been experienced with air bubbles.
Plastic Dyes	**Poly Supra Concentrate Molding Powder Dyes**	Powder dyes that give clear and transparent color effects. Variation in depth of color controlled by amount used. Available in red, royal blue, blue-green, orange, amber, purple, black, and yellow.	For addition to cellulose-acetate, polystyrene, Lucite, Plexiglas, and vinyl molding powders.
Porcelain-like Finish	**Porcelanite**	A semi-glazed finish that protects iron or steel surfaces to which it is applied. Prevents scaling of metal when subjected to high heat and reduces corrosive action of gases, flue dust, and slag in furnaces.	For protecting cold-rolled and cast-iron burning racks, burning tools, iron and glass furnace interiors, ladle linings, etc.
Enamel	**Porciflex**	Fast-drying baking enamel with high resistance to acids, alkalies, oils, and greases. Requires baking only for periods varying from 1 minute at 450 degrees F. for sheet steel to 15 minutes at 275 degrees F. for other types of work. Is well adapted to infra-red baking. Available in colors as well as transparent finish.	Applicable generally where enamel is called for.
Prepainting Solution	**Prepaint**	A material that reacts chemically to bond with aluminum surfaces in from fifteen to sixty seconds after application. Paint or lacquer is applied immediately after this preparation with improved adhesion and uniformity of coverage.	For application to aluminum or aluminum-alloy products that are wrought, cast, die-cast, machined, forged, or extruded.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Protective Coating	**Protecto-Coat**	Cellulose compound that provides a tough yet pliable coating. Applied by dipping and sets quickly on contact with air. Is readily removed by slitting and peeling.	For protection of tools during shipment and storage.
Cleaner	**PSC**	Emulsion type cleaner that cleans ferrous and non-ferrous metals and inhibits them against rust, corrosion, and hand soil. Non-toxic and non-injurious to skin. Requires no rinsing.	For cleaning, ferrous and non-ferrous metals and removing grease, oil, wax, lapping and drawing compounds, abrasive dust, chips, etc.
Grinding Fluid	**Quaker Microgrind 70**	Water-soluble grinding fluid that does not become rancid or develop disagreeable odors even when mixed with hard water or when used for grinding cast iron.	Developed for use with Quaker Microgrind process. Gives excellent results on all types of steel and most other metals.
Aluminum Alloy	**R 317**	Aluminum - copper-manganese-magnesium alloy (17 S) with small additions of other metals to improve the machining characteristics. Can be forged.	Developed primarily for machining stock. Offers advantages where forged parts with free-machining qualities are desired.
Structural Material	**Reynalite**	Light-weight, high-strength structural material consisting of two sheets of aluminum bonded with a plastic adhesive to a cellulose core. Material is easily worked and has permanent rigidity.	Suitable for construction of walls, ceilings, roofs, interior panels, doors, cabinets, refrigerator linings, electrical cabinets, air ducts, etc.
Rack Coating	**RX-2500**	A white opaque and glossy coating that is unaffected by hot alcoholic reverse-current cleaners and such oxidizing agents as chromic acid and 40 per cent nitric acid. Has high resistance to organic solvent cleaners.	For application to electroplating and pickling racks.
Enamel Stripper	**S-300**	Stripping compound that removes enamels cleanly by a wrinkling action. Does not attack the base metal nor are phosphate or anodized coatings affected by its action.	Useful for removing many types of organic coatings. Synthetic enamels, such as alkyds, melamine, and urea formaldehyde coatings, are readily removed.
Cleaning Compound	**Sand Re-nu**	Compound used for removing pitch, resinous substances, and metal embedded in sandpaper, emery cloth, and metal files.	Flexible abrasive belts and metal files are cleaned by soaking in solution. Solid wheels, buffing wheels, and disks are treated by brushing.
Plastic Waterproof Coatings	**Saran F-120** **Saran F-122**	Saran F-120 produces extremely dense, impervious coatings, completely waterproof and more moisture-vapor-proof than organic coatings. Affords close approach to metal foil from standpoint of moisture protection. Has high resistance to solvents, oils, greases, acids, and alkalies. Saran F-122 latex coatings are designed for easy application from an entirely aqueous system. Upon air-drying, tough, clear, glossy films are formed. No baking required.	For use wherever waterproof or moisture-vapor-proof protection is required.
Permanent-magnet Material	**Silmanal**	This material has a high intrinsic coercive force. It is ductile and malleable, and can be punched, machined, rolled, or ground.	Useful in instruments where service in strong electrical fields is required.
Die Steel	**Silver-Hardtem**	A prehardened die steel of improved service life and machinability. Can be furnished in any desired hardness.	Available as die-blocks, die-block bars, and inserts for use in zinc-alloy die-casting.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Die Steel	**Speed-Cut**	A free-machining die steel that permits hardening prior to machining. Is said to machine as readily at 390 Brinell as other steels used for similar purposes in the annealed state.	Particularly adapted for plastic molds and for die-casting dies for white-metal alloys.
Protective Compound	**Spray-Peel**	A plastic compound, applied by brushing or spraying, that dries to a rubbery film, insuring a moisture-proof seal that is resistant to abrasion, salt water, aromatic spirits, and oils, alkalies, and acids. It is readily removed by stripping.	For over-all product protection.
Stainless Steel	**Stainless W**	Heat-treatable stainless steel of the 18-8 type. In the annealed condition, this steel has a hardness of 22 to 28 Rockwell C, a tensile strength of 120,000 to 150,000 pounds per square inch, and a yield strength of 75,000 to 115,000 pounds per square inch. By proper heat-treatment, the hardness can be raised to 39 to 47 Rockwell C, the tensile strength to 195,000 to 225,000 pounds per square inch, and the yield strength to 180,000 to 210,000 pounds per square inch.	Many applications are anticipated, particularly in bar form. Also available for use in all commercial forms. Although stiff to work, can be used for deep-drawing.
Greases	**Starfak L, M, and H**	Greases with improved oxidation and heat resistance and better low-temperature characteristics.	For general applications wherever these greases have been called for.
Ground Flat Stock	**Starrett**	Two types of precision ground flat stock. One is spheroidized-annealed and has fine grain structure and deep hardening characteristics suitable for precision parts requiring accuracy of size after hardening. The other is a high-grade tool steel, annealed for easy machining, which develops maximum hardness when quenched in water or brine.	Designed to expedite production of precision parts and pieces, such as die parts, flat gages, drill jigs, templets, machine and fixture parts, and other small parts having two flat parallel surfaces.
Plastic	**Styraloy**	An extremely light plastic that retains its flexibility at low temperatures.	When combined with synthetic rubber, imparts more flexibilty at low temperatures, better electrical properties, and reduces water absorption. Developed for use as cable sheathing.
Drawing Compound	**Superdraw**	Maintains inherent physical properties during repeated stamping operations on ferrous and nonferrous alloys. Is unaffected by atmosphere and heat, and leaves no heavy scale or stain on alloy. Is easily removed by an alkaline cleaner.	For use in stamping of ferrous and non-ferrous metals.
Soldering Flux	**Superior No. 30**	Organic soft soldering flux, said to be more effective than common rosin fluxes. Although not offered as a general substitute for zinc-chloride fluxes, it can be substituted where that or similar strong acid fluxes cannot be used because of possible corrosion. Also recommended for applications where rosin alcohol is not satisfactory.	Can be applied in soldering copper, steel, silver, brass, various alloys, and electroplated parts, such as nickel plate, silver plate, and cadmium plate.
Concrete-floor Repairing Compound	**Swift-Floor**	A compound containing no asphalt, cement, or gravel that sets by compression rather than by water evaporation. It does not crack, crumble, or curl, and can be rolled to a feather edge.	For repairing concrete floors.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Dustproofing Compound	**Synkrete**	Liquid concentrate which, in diluted form, penetrates into concrete, filling the pores and reacting to form a hard rock-like, impenetrable mass.	To prevent "dusting" of concrete floors.
Synthetic Enamels	**Synox**	Group of all-synthetic enamels that give an exceptionally hard, stainproof finish, designed to endure heavy usage. High degree of water and alkali resistance, stain resistance, and color retention.	Designed for refrigerators, stoves, ironers, electric mixers, dish-washers, and washing machines.
Plastic	**Teflon**	Withstands acids which dissolve gold and platinum, and retains its strength and form at high temperatures.	Applicable in jet engines. Suitable for industrial uses in cases where unusual resistance to solvents and corrosive agents and heat endurance are important characteristics.
Drawing Compound	**Texaco No. 2**	A drawing compound with pastelike consistency that is easily washed from a completed piece with water.	Particularly adapted for use in stamping and drawing operations.
Water-repellent Grease	**Texaco Star Grease No. 0**	A grease made with lime soap that is heat-stable, water-repellent, and non-separating.	For factory lubrication of tractor track rollers and other applications requiring similar properties.
High-frequency Resistant Plastic	**Textolite No. 1422**	A plastic material possessing a very low power factor with an ASTM heat distortion of 105 to 113 degrees C. Can be machined on automatic or semi-automatic fabricating equipment. Being a cast plastic, is applicable to small-quantity production.	Particularly suitable for ultra high-frequency insulating applications.
Casting Sealing Compounds	**Thalid X-100**	Series of plastic thermosetting impregnating solutions used in place of tung oil. The sealing resins have good resistance to 100-octane, 40 per cent aromatic gasoline, ethylene glycol, lubricating oil, mineral spirits, and liquid trichlorethylene.	For sealing aluminum and magnesium castings.
Thermit	**Thermicast**	New type of thermit which is supplied with a metal crucible, receiving ladle, and slag-collecting basin to produce steel castings.	For producing a mild steel of about 0.25 per cent carbon, 0.68 per cent manganese, and 0.11 per cent silicon content.
Aluminum-Bronze Stock	**Torrance Standard Bronze**	Tough, centrifugally cast aluminum-bronze bushing stock with maximum density, uniform grain structure, and absence of inclusions.	For use in aircraft, automotive, and maritime industries, or wherever bronze bushings are required.
Protective Coating	**Triad PR**	A protective coating that provides a light-reflecting surface which withstands mild abrasion. It can be easily cleaned and flushed off with water or steam.	For application to side walls of either wet or dry spray booths.
Rack Insulator and Protective Coating	**Tygoflex Rack Coating**	A coating that, after being applied by dipping, spraying, or brushing, is subjected to heat for a short period to convert it to a thick, impermeable insulator resembling a black rubber compound of medium hardness. Is resistant to all plating-acid or alkaline solutions at temperatures up to 250 degrees F. Unaffected by abrupt temperature changes.	As a protective insulator on electroplating racks and process equipment.

Review of Some Recently Developed Materials — Continued

Class of Material	Trade Name	Properties	Applications
Tool Steel	**Type R**	Tool steel consisting of high-carbon and low-carbon steels in a composite section, providing hardness and edge-holding properties, with a high shock resistance.	For use in chipper knives, planer knives, paper knives, and blades for cutting light sheet metal.
Organic Coating	**Ucilon**	An organic coating material especially formulated to provide high resistance to a wide variety of corrosive conditions. Is resistant to acids, alkalies, and salts, and is unaffected by oils, gasoline, and alcohols, including vegetable and fish oils, commercial alcohols, lubricating oils, greases, and other petroleum derivatives.	For application wherever protection against corrosion is desired. Will adhere firmly to properly prepared metal, wood, and concrete surfaces.
Corrosion Protective Process	**Unichrome Dip**	Converts either cadmium or zinc surfaces to chemically inert compounds. Black or olive drab finishes can be produced. Provides an excellent base for paint or lacquer.	For application to cadmium and zinc surfaces where corrosion is a factor.
Gasket Sealing Compound	**Uniseal**	General-purpose thread and gasket sealing compound that is proof against air, water, steam, gas, gasoline, oil, hydraulic fluids, and aromatics. Its solubility in alcohol and carbon tetrachloride permits easy removal.	For general thread and gasket sealing applications.
Permanent-magnet Material	**Vectolite**	The first non-metallic, non-conducting magnet material to be produced. A hardened, sintered combination of iron rust and cobalt oxide, mixed in powder form. This material has high resistance to demagnetized forces.	Applied where extremely light, non-conducting magnets are advantageous.
High-speed Steel Rounds	**Vee-Oginized Steel**	High-speed steel rounds produced by a process that insures centers free from carbide segregation.	For usual applications of high-speed steel rounds.
Die Steel	**Vega**	Air-hardening, non-deforming die steel with deep-hardening characteristics of air-hardening steel and responsiveness to low-temperature heat-treatment of oil-hardening steels. Can be heat-treated at 200 degrees F. lower than 5 per cent chromium air-hardening steels.	Especially suited for tools used in blanking, piercing, trimming, and forming sheet metal in both light and heavy gages.
Pre-paint Surface Conditioner	**Wash Primer**	A metal surface-conditioning agent that replaces the customary inhibitive wash coat. Acts also as priming coat, which gives temporary protection before painting. Overcomes many difficulties previously experienced with surface-conditioning coatings, such as freezing, lack of uniform deposit, and poor water resistance.	Provides excellent adhesion with fair degree of flexibility when applied to steel, aluminum (anodized and unanodized), tin, galvanized iron, stainless steel, and similar metals.
Wood Glue	**Wood-Lok**	A cold-run fast-setting resin wood glue that requires no heating. It can be handled and machined after twenty to thirty minutes' clamping time. Produces a strong, resilient bond that is unaffected by humidity.	Especially developed for wood joint assembly operations.
Anti-corrosive Process	**Zincilate**	A process for coating ferrous metals which is said to provide twenty years' protection against all common types of corrosive action. Only one coat is needed, and this has high abrasion resistance.	Has been used successfully on pipe lines, on the interiors and exteriors of water and gasoline tanks, on bridges, machine parts, and marine installations.

Bore-Diameter Checking Method

By C. H. BORNEMAN, Supervisor of Tool and Gage Service
General Electric Co., Schenectady, N. Y.

THE instrument for checking bore diameters in long cylinders described by Daniel E. MacDonald on page 192 of the December, 1945, number of MACHINERY, results in readings that are somewhat inaccurate. This can be demonstrated by comparing the actual difference in diameters at one end and at some point along the interior of the cylinder with the indicated difference at these points as determined by the instrument.

Referring to the accompanying diagram, in which the difference between the two diameters

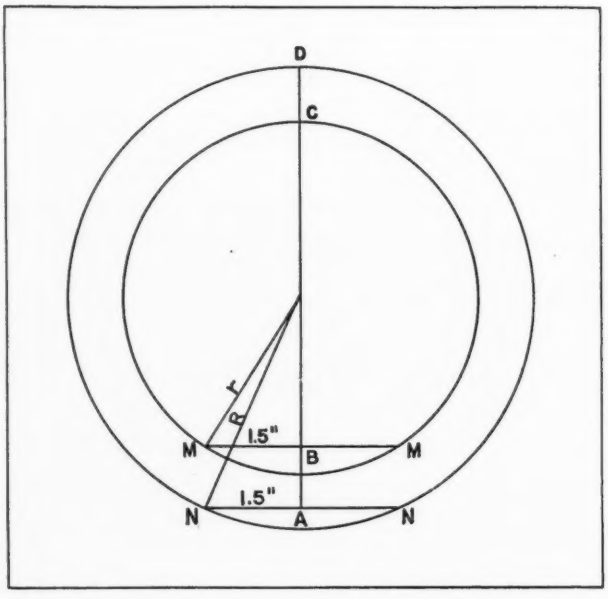


Diagram Used in Checking Error in Bore Diameter Readings. M-M and N-N Show Positions of Instrument Base for Two Different Bore Diameters. This Difference is Greatly Exaggerated for Clarity

has been greatly exaggerated for the sake of clarity, let

r = radius of bore at one end as determined by measurement;

R = actual radius of bore at some given position along the cylinder, to be computed;

x = actual difference in diameters at positions of radius r and radius R, to be computed;

y = indicator reading of difference in diameters;

M–M = the plane of contact of the instrument base when located at the position along the bore where the radius is r; and

N–N = the plane of contact of the instrument base when located at the position along the bore where the radius is R.

If the distance (BM or AN) from the point of contact between the instrument base and the cylinder bore to the center of the indicator post is 1.5 inches, then

$$BC = r + \sqrt{r^2 - 1.5^2}$$

$$AD = R + \sqrt{R^2 - 1.5^2}$$

But

$$y = AD - BC$$

Hence

$$AD = BC + y$$

and

$$R + \sqrt{R^2 - 1.5^2} = r + \sqrt{r^2 - 1.5^2} + y$$

If

$$r = 2.0000$$

and

$$y = 0.0010$$

$$R + \sqrt{R^2 - 2.25} = 2.0000 + \sqrt{4.0000 - 2.25} + 0.001$$

$$R + \sqrt{R^2 - 2.25} = 3.324$$

$$R - 3.324 = -\sqrt{R^2 - 2.25}$$

Squaring both sides

$$R^2 - 6.648R + 11.049 = R^2 - 2.25$$

$$6.648R = 13.299$$

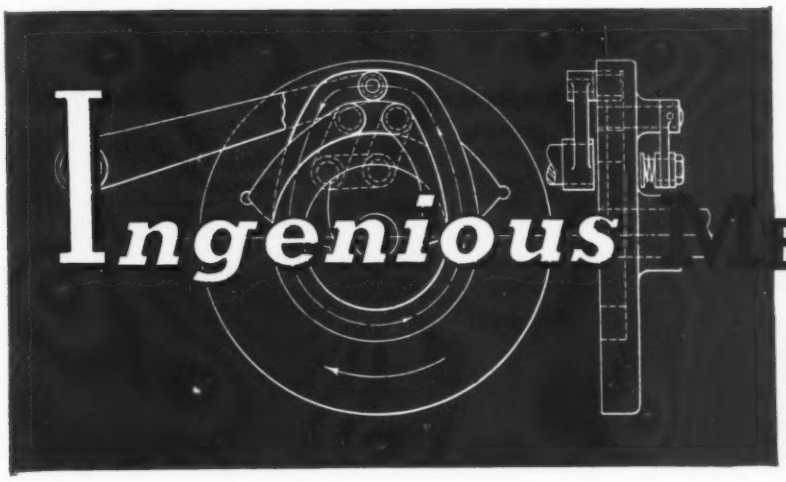
$$R = 2.0004$$

The actual difference x in the two diameters is

$$x = 2(R - r) = 2(2.0004 - 2.0000) = 0.0008 \text{ inch}$$

for an indicator reading y of 0.001 inch.

When exact measurements are required, a table of actual differences in diameter for corresponding indicator readings may be computed for reference.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Oscillating Motion Transmitted from Vertical to Horizontal Plane

By L. KASPER

The oscillating motion of a part in a vertical plane is transmitted to another part in a horizontal plane by means of the simple mechanism illustrated in Figs. 1 to 3. The magnitude of the oscillations is adjustable to suit various requirements.

A front elevation and plan view of the mechanism in the central or middle position of its cycle are illustrated in Fig. 1. Lever *G* oscillates in a horizontal plane about pivot rod *H*. Rod *F*, the position of which is adjustable in the slot of lever *G*, is fastened to the lever and operates with it. Part *E* is free to slide vertically on rod

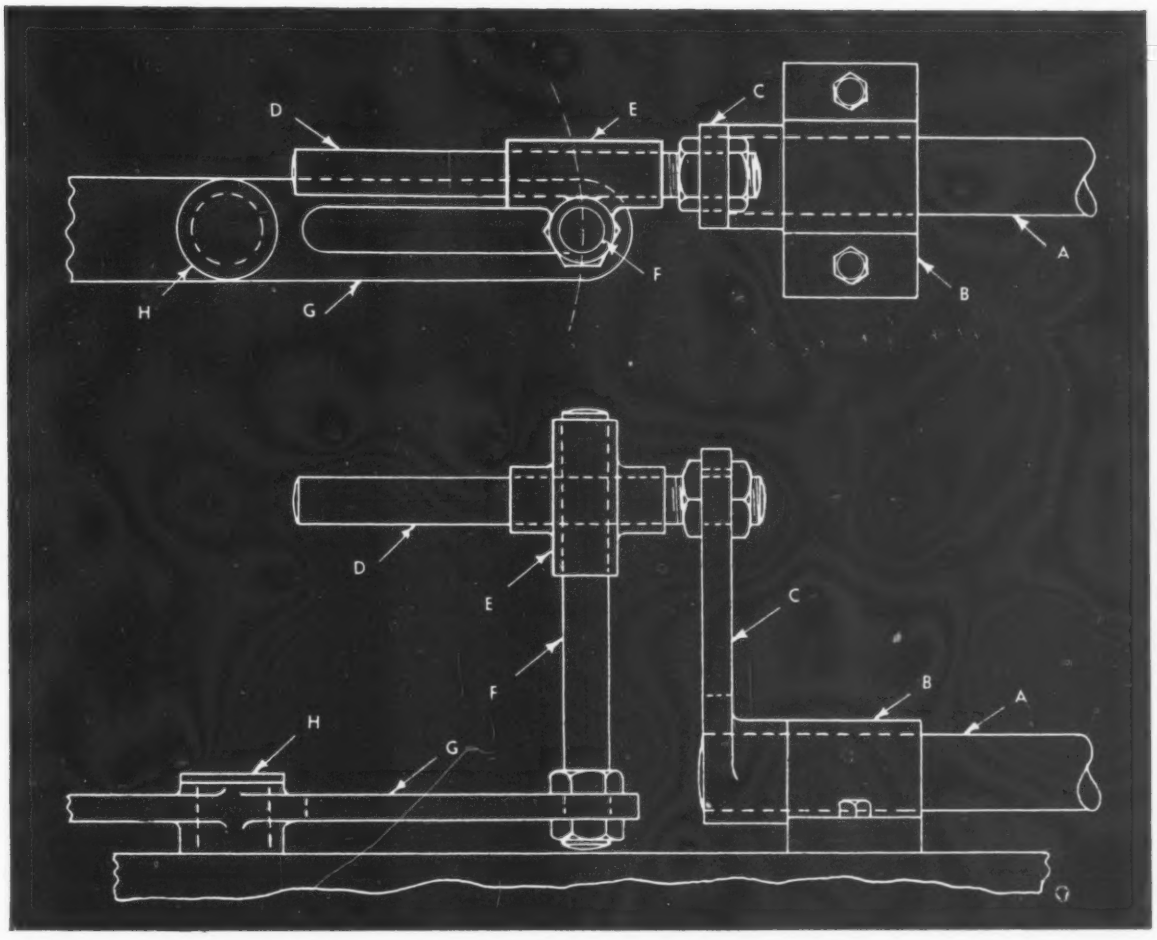


Fig. 1. The Oscillation of Lever G in a Horizontal Plane is Transmitted to Lever C, which Oscillates in a Vertical Plane

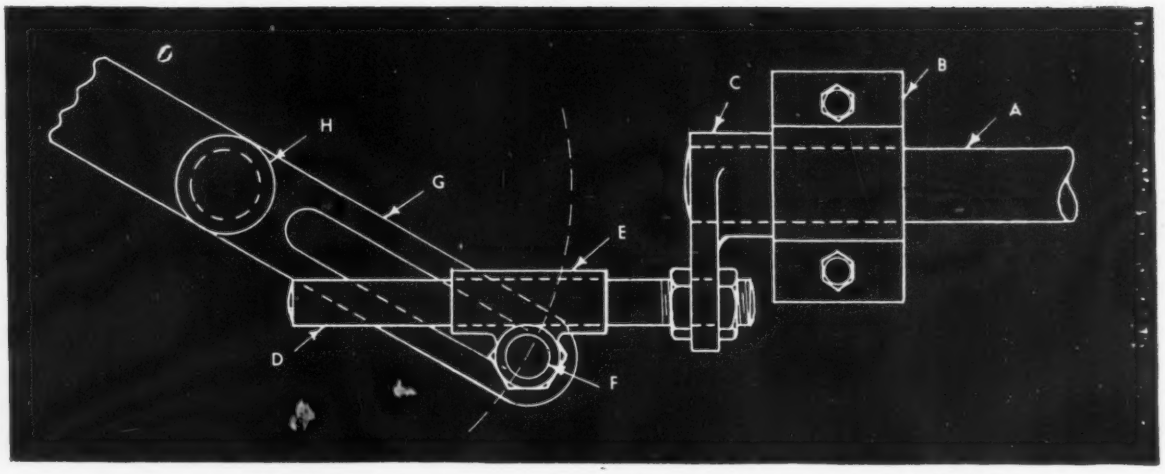


Fig. 2. Mechanism Shown in Fig. 1 Illustrated in the Extreme Forward Position

F and horizontally on rod D. Rod D is fastened to lever C and can be adjusted by the slot in the lever. Lever C is keyed to shaft A, which confines the movement of the lever to an oscillating motion in a vertical plane. Shaft A turns in bearing B. Thus, the oscillating motion of lever G in a horizontal plane is transmitted to lever C, which oscillates in a vertical plane.

The extreme forward position of the mechanism is illustrated by the plan view in Fig. 2. Part E has moved out on rod D, away from lever C, and down on rod F, to permit movement of levers C and G, each in their respective planes.

A left-hand end view of the mechanism when in the position indicated in Fig. 2 is shown in Fig. 3. Adjustment of the amount of oscillation is accomplished by changing the position of rods D and F in the slots of their respective levers.

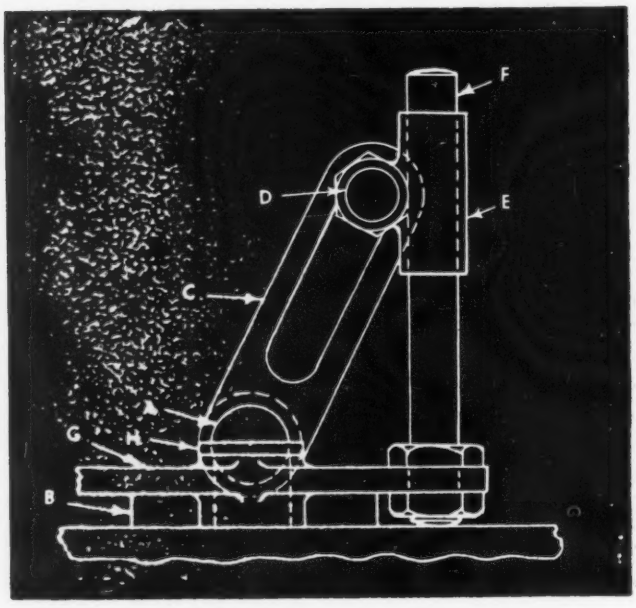


Fig. 3. Left-hand End View of the Mechanism when in Position Indicated in Fig. 2

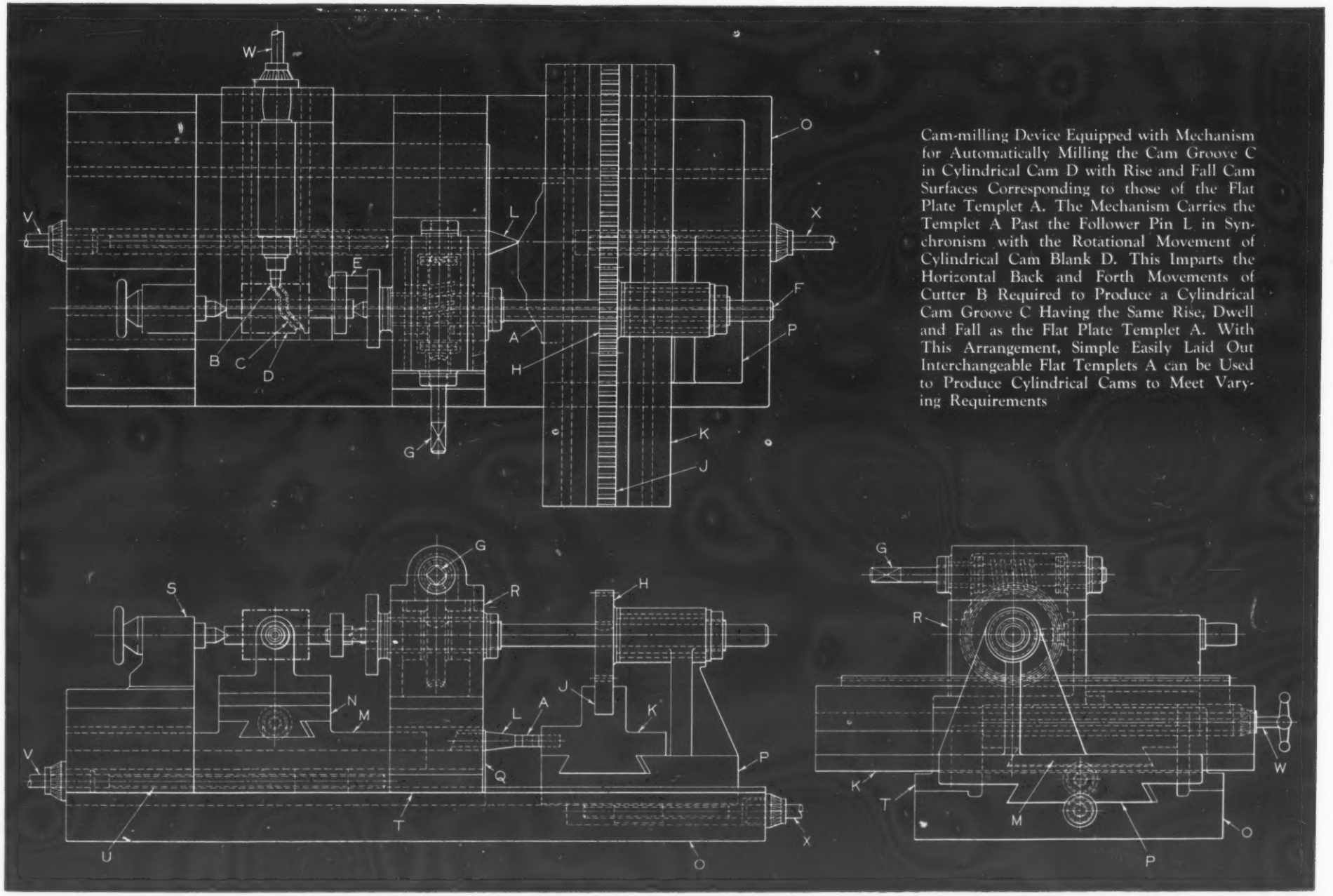
Mechanism for Controlling Cutter-Head Slide of Cam-Generating Device

By CHARLES and DAVID GOLOSMAN

A rotating disk-and-pin mechanism for controlling the cutter-head slide of a device for automatically generating harmonic-motion cams was described and illustrated in August, 1946, MACHINERY, page 189. Another automatic cam-generating device with a templet and follower-pin mechanism for controlling the cutter-head slide is shown in the accompanying illustration. One of the chief advantages of the mechanism here illustrated is the comparative ease with which the flat-plate master profile or contour templet A can be developed, laid out, and machined, as compared with the work involved in developing the lay-out on a master cylindrical cam blank and machining the cam groove directly on the cylindrical blank.

Use of the flat-plate templet is especially advantageous in the case of slow-moving, uniform-motion cams in which the developed profile diagram of the various rise-and-fall surfaces consists of simple inclined straight lines. For this reason, development templets made from steel plate or flat ground stock are employed, as shown at A in the illustration, for the mechanism that controls the slide on which the cutter B is mounted for generating the cam groove C in the cylindrical blank D.

The cam blank D in which groove C is to be cut is mounted on an arbor between centers with a driving pin E arranged to rotate the work when the spindle F is rotated by turning worm-shaft G either with a hand-crank or a motor equipped with a reduction-gear drive. The worm on shaft G, meshing with the worm-wheel on shaft F, rotates pinion H, as well as the work.



Cam-milling Device Equipped with Mechanism for Automatically Milling the Cam Groove C in Cylindrical Cam D with Rise and Fall Cam Surfaces Corresponding to those of the Flat Plate Templet A. The Mechanism Carries the Templet A Past the Follower Pin L in Synchronism with the Rotational Movement of Cylindrical Cam Blank D. This Imparts the Horizontal Back and Forth Movements of Cutter B Required to Produce a Cylindrical Cam Groove C Having the Same Rise, Dwell and Fall as the Flat Plate Templet A. With This Arrangement, Simple Easily Laid Out Interchangeable Flat Templets A can be Used to Produce Cylindrical Cams to Meet Varying Requirements

Pinion *H*, meshing with rack *J* on slide *K*, causes slide *K* to be traversed at right angles to the axis of shaft *F* simultaneously with the rotation of cam blank *D*.

As slide *K* moves transversely, the cam profile of templet *A* transmits longitudinal movement to slide *Q* through follower-pin *L*. The compound cutter-slides *M* and *N*, mounted on slide *Q*, thus traverse the cutter *B* longitudinally to the left or right along the axis of the cam blank *D* in accordance with the profile or contour of the cam templet *A*. This simultaneous rotation of the cylindrical cam blank *D* and traversing movement of the rotating end-milling cutter *B* results in milling the cam groove *C* with the required rise-and-fall contours predetermined by the contour or profile of cam templet *A*. During the cam milling operation the follower-pin *L* is kept in contact with templet *A* by means of a cable and weight (not shown), which is attached to the end of the slide *M*.

Referring to the structural details of the device, base *O* is provided with machined ways throughout its entire length and carries the two longitudinal slides *P* and *Q*. Slide *P* is cast integral with the bracket bearing which supports work-spindle *F*, and it also carries the cross-slide *K* with rack *J* and templet *A*.

Slide *Q*, supporting follower-pin *L*, carries the compound slide *M*. Slide *N* is mounted on slide *M* and carries the spindle of cutter *B*. Headstock *R* and tailstock *S* are mounted on bridges *T* and *U*, respectively. Gear *H*, which is cast integral with a long sleeve bearing and is keyed to the work-spindle *F*, drives rack *J* secured to cross-slide *K*, thus imparting the traverse movement to templet *A*, as previously described.

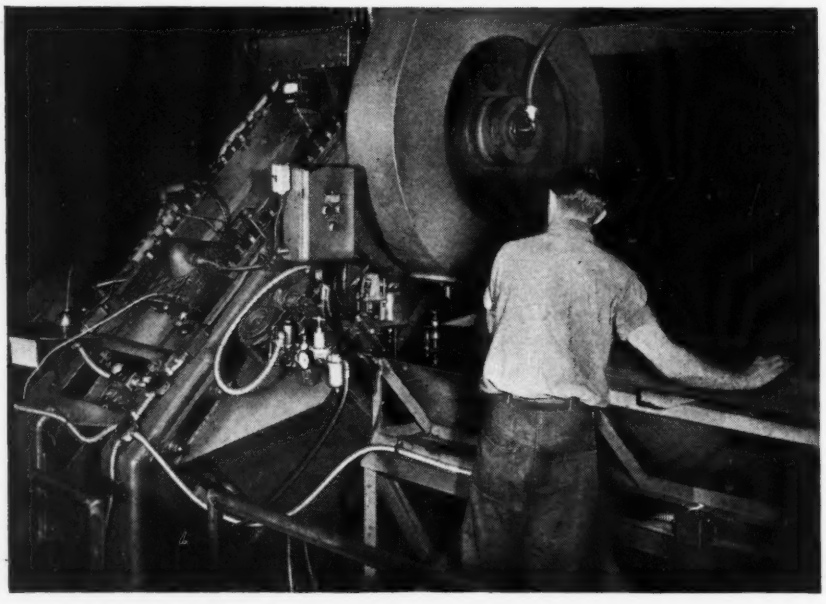
Compound slide *M* is provided with a long feed-screw *V*, which enables the cutter *B* to be set in any desired position along the surface of the work. Cross-slide *N*, carrying the spindle head, is provided with cross-feed screw *W* which enables cutter *B* to be adjusted radially to any desired distance from the center of the work. Screw *W* is also used for feeding the cutter into the work. The setting of slide *P* to accommodate templets of various sizes is accomplished by means of screw *X*.

* * *

Shortage of Technical Man-Power

Companies are short of technically trained men today, and competition for these men is keener than it ever was, according to H. N. Muller, manager of the educational department for the Westinghouse Electric Corporation. Engineering colleges report that there is an increase of 100 per cent in the number of companies now interviewing their graduates, in comparison to pre-war years.

This latest man-power shortage, Mr. Muller predicted, will last well into 1949 or 1950. It stems directly from industrial expansion, coupled with the relatively few engineers and scientists graduated from colleges during the war. The Westinghouse Electric Corporation alone is now recruiting from the colleges over one hundred more men each year than during pre-war years.



Three Minster Inclinable Punch Presses in the Cleveland Plant of the Reliance Electric & Engineering Co. were Recently Equipped with Adjustable-speed, All-electric Drives to Speed up Production of Electric Motor Stator and Rotor Laminations. Increased Output was Obtained Because the Drive Made it Possible to Change from Semi-automatic to Automatic Operation, and thus Utilize the Equipment over its Complete Range of 30 to 120 Strokes per Minute

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time-and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

High-Lift Power Jack Facilitates Installation of Heavy Machinery

The installation or removal of heavy machinery is a difficult undertaking, especially in buildings having low ceilings or trusses. This is a particular problem in automotive plants where machines constantly have to be moved due to the changes in automobile models. Such changes frequently necessitate the moving of 50 per cent or more of the machinery in certain plants.

In seeking to facilitate the moving of machines, engineers of the Chevrolet Gear & Axle Division of General Motors Corporation designed and built the high-lift power jack here illustrated. This jack can be used to install or remove presses or other machines weighing as much as 150 tons without disassembling the machine. Such jobs are now done with comparative ease, and the cost of moving machinery has been reduced by as much as 75 per cent.

The jack, details of which are shown in Fig. 1, is built on the screw and nut principle, and is air-operated. It is always operated in compression, so that any failure of mechanical parts within the jack will not result in a change in

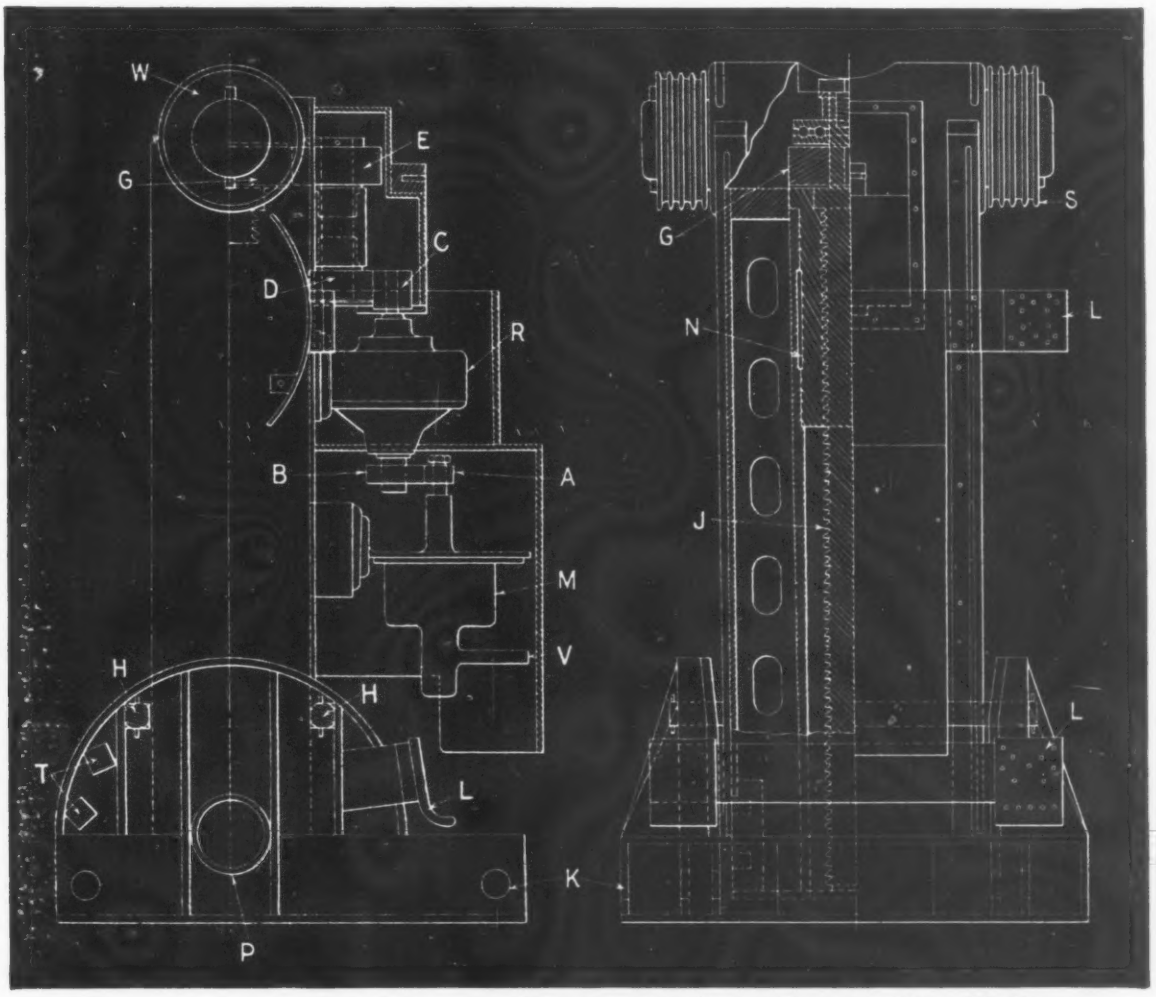


Fig. 1. Air-operated, High-lift Power Jack Used for Installing or Removing Heavy Machinery

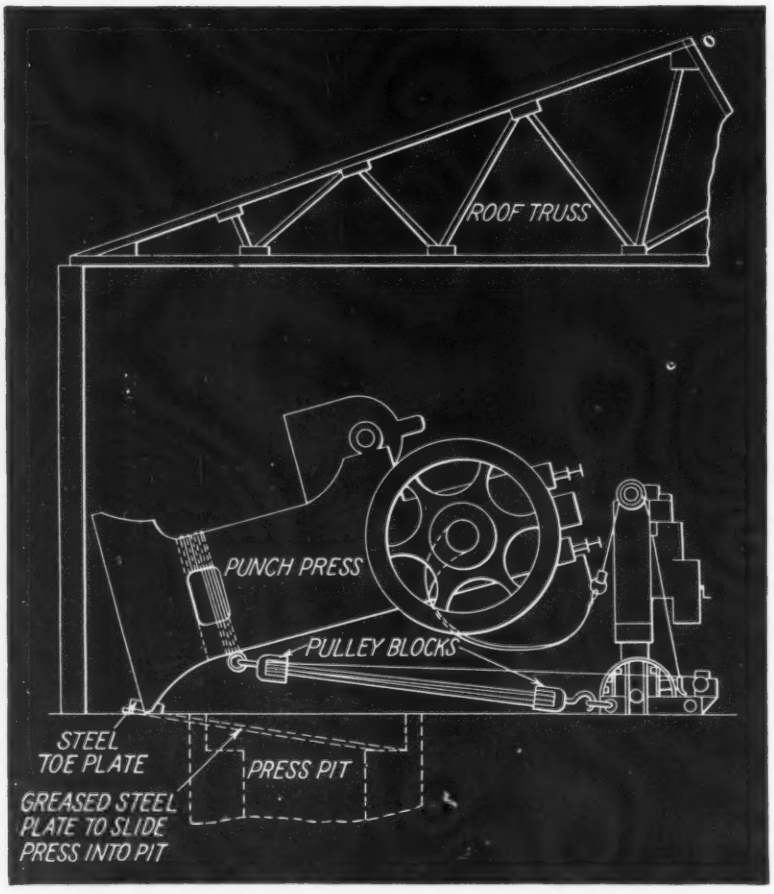
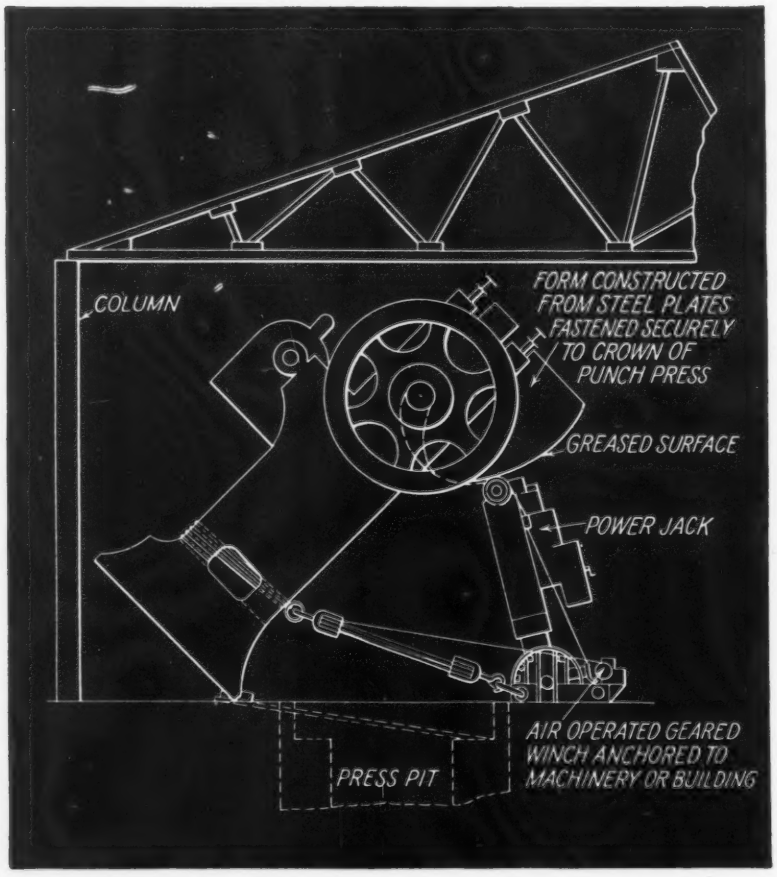


Fig. 2. (Above) Jack Shown in Fig. 1 being Used for Installing a Heavy Punch Press


COLUMN
FORM CONSTRUCTED FROM STEEL PLATES FASTENED SECURELY TO CROWN OF PUNCH PRESS
GREASED SURFACE
POWER JACK
AIR OPERATED GEARED WINCH ANCHORED TO MACHINERY OR BUILDING
PRESS PIT

position of the weight being lifted. The jack is 7 feet 3 3/8 inches high, with the ram head in the lowered position, by 4 feet wide, by 4 feet deep. The ram head can be elevated to give an over-all height of 12 feet 8 inches.

Ram head *W* is elevated or lowered by the buttress-threaded jack screw *J*, which moves through the stationary nut *N*. The screw is turned by gear *G*, which is keyed to it. Gear *G* is driven by the air motor *M* through gears *A*, *B*, *C*, *D*, and *E*. The air motor revolves gear *A* at 650 R.P.M. and develops 9.5 H.P. with an air supply of 90 pounds per square inch. The motor is controlled by valve *V*. Speed reducer *R*, having a ratio of 56 to 1, is interposed between gears *B* and *C*.

The jack can be swiveled around the pivot bearing *P*, which is constructed of 8-inch diameter pipe. This is accomplished by moving the holding bars *H* to other positions in openings *T* in the base *K*. Bars *H* are 2 1/2 inches square by 38 inches long.

One application of this jack is illustrated in Figs. 2 and 3, which show it being used for installing a large punch press. The jack is especially adapted for handling machines weighing from 40 to 150 tons in buildings having restricted heights. Punch presses that extend into the roof trusses formerly required the removal of a section of the roof and the erection of hoisting equipment to dismantle the press before it could be moved. Now even such presses can be moved intact. The elimination of the need for dismantling the machine, removing part of the roof, and erecting hoisting equipment has reduced the man-hours required for moving these presses by as much as 60 per cent.

In the installation illustrated, it was necessary to construct a form

Fig. 3. When the Press has been Lifted to a Certain Height, the Jack is Moved toward It, and the Installation is Continued by the Ram Head Acting against the Press or Form

Fig. 4. Punch Press Weighing 260,140 Pounds being Installed by the Use of the Jack Illustrated in Fig. 1

from steel plates and fasten it securely to the crown of the punch press. Wire rope cables were passed around the shaft of the press, along the greased surface of the steel form, and around the four-grooved jack sleeves *S* (Fig. 1), being clamped in the jack cable clamps *L*.

Other cables are wrapped around the base of the machine, connected to pulley blocks, and pulled by an air-operated geared winch. As the ram head of the jack is elevated, thus lifting the top of the press, the base is pulled toward the pit by means of this winch and the steel toe plate which slides on a greased steel plate. This toe plate is prevented from buckling under the weight of the press by wood blocking located in the pit. Both blocking and plate are removed after the press has been drawn into place. When the press has been raised to a certain height, it is possible to place the jack under the form or press and thus supplement the erection by pushing the ram against the form or press.

The power jack is shown in Fig. 4 being used to install a 900-ton Toledo press. This press, assembled as shown, weighs 260,140 pounds. It was moved intact from its foundations in one plant to an adjoining plant and installed within eight days, which represented 534 man-hours.

The saving in time and labor costs is even greater where the machines are moved from place to place in the same plant. In such cases, the power jack can be arranged on the same skids with the machine, and the whole moved as an assembly, with the machine in an inclined position. The time required to lower the machine completely and set up the equipment at the new location is thus saved.

* * *

Carbide Milling Slide-Rule

A rapid pocket calculator for computing speed, feed, and horsepower for carbide milling operations has been made available by the Super Tool Co., Detroit 13, Mich., manufacturer of standard and special carbide tools. In addition to the speed and feed data, the slide-rule gives the proper cutter to be used for various hardnesses and types of steels, as well as for nonferrous metals. Further information can be obtained directly from the company.

* * *

Index to American Standards

The American Standards Association, 70 E. 45th St., New York 17, N. Y., has published an index and price list covering the 874 standards of the Association. The list is classified according to industries. Those interested can obtain copies, without charge, by applying to the Association.

Recommendations for the Band-Sawing of Steel Molding

By H. J. CHAMBERLAND

IN contrast to the band-sawing of flat stock, where the thickness of the material being cut remains constant, the sawing of steel molding presents a problem due to the various cross-sections encountered by the band-saw blade. The cross-sections of eight typical mild steel moldings varying from 3/32 to 1/8 inch (drawn about to scale) are shown in the illustration. These sections are divided into two groups, and recommendations for the band-sawing of the shapes included in each group are given in the following. Such recommendations are based upon the results of tests made by the DoAll Co.

A 1/4-inch wide, 32-pitch, wave-tooth type of saw blade operating at a speed of 100 feet per minute is recommended for sawing steel moldings such as those shown in group 1. For shapes *A* and *B*, a medium feeding pressure is recommended, while for shapes *C* and *D*, a light pressure is preferable. With this practice, production should approximate nine cuts through shape *A*, fourteen through *B*, twelve through *C*, and six through *D* per minute. Saw blades having a coarser pitch can be used for cutting these shapes, but the production rate will not be increased and a heavier burr will result.

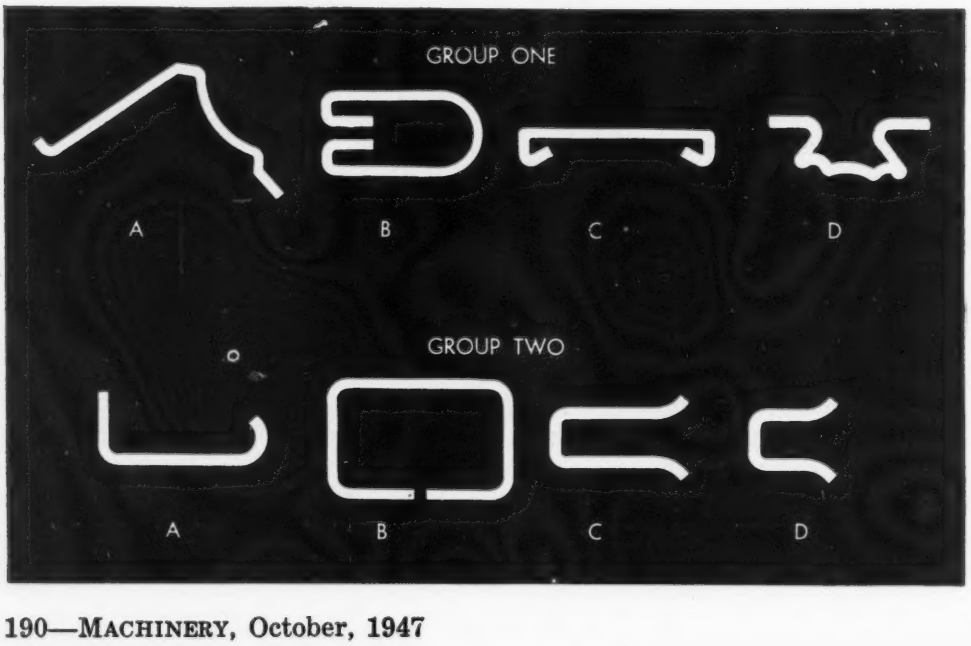
The band-sawing technique recommended for the shapes of steel moldings shown in group 2 includes the use of a 1/2-inch wide, 18-pitch, raker-tooth type of saw blade, traveling at a speed of 100 feet per minute. A medium feeding pressure is desirable for sawing all these shapes. Production rates, which are based on maximum tool life and minimum burr, should approximate two pieces cut from molding *A*, six from *B*, twelve from *C*, and sixteen from *D* per minute. The production rate of any of these shapes can be increased by sacrificing tool life and finish.

For sawing thicker sections of steel molding, coarser-pitch saw blades traveling at a reduced surface speed are preferable. Thinner sections of such shapes can be sawed more effectively with the finer, 32-pitch, wave-tooth type of saw blade, operating at no increase in the recommended surface speed.

No two moldings or extrusions of different cross-sections can be sawed in exactly the same way, but the practice here recommended will help materially to establish the most efficient technique for the operation being performed.

* * *

To decrease the size and weight of electronic devices, engineers have been gradually reducing the size and complexity of vacuum tubes. This work was recently given impetus by the development of a tube smaller than the eraser of a lead pencil—only a trifle larger than a grain of rice—by the National Bureau of Standards. This device, known as the "microtube," was designed primarily for military applications. Other miniature tubes, however, have been developed that are suited for a variety of industrial uses, including such applications as detectors, amplifiers, rectifiers, and oscillators.



Different Techniques are Required in Band-sawing the Eight Cross-sections of Steel Moldings Here Illustrated. Specific Recommendations for Each Group are Given in This Article

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Brown & Sharpe Automatic Pinion-Turning Machine

An automatic pinion-turning machine designed to simplify duplication of precision set-ups for machining small pinion and staff work of high accuracy is a new development of the Brown & Sharpe Mfg. Co., Providence 1, R. I. All adjustments and controls on this machine, which is shown in Fig. 1, have been simplified and arranged to maintain accuracy without requiring the services of highly skilled operators.

The machine will take stock up to 1/4 inch in diameter, and will turn any length up to 2 7/8 inches. Change-gears provide for the selection of production rates from 3 to 364 seconds for one piece per cycle. Sixteen spindle speeds ranging from 10,000 down to 910 R.P.M. are available. The 2-H.P. constant-speed driving motor, mounted on an adjustable bracket inside the base, is started and stopped by push-buttons. The drive is through a V-belt and change-gears to a shaft in the base and thence by belt to a pulley on the spindle.

The stock is held by a spring collet at the front end of the spindle. The collet is opened and closed automatically in conjunction with the operation of the stock-feeding finger at the end of the feed-tube directly behind the collet. Automatic operation of the collet and stock feed is controlled by trip-dogs at the front of the machine.

The eight-tool turret, shown in Fig. 2, has its axis parallel to the machine spindle, and is provided with a micrometer adjustable stop for each tool position. The turret carrier arm is pivoted to give transverse movement to the tools. The tools are of a novel circular-formed single-point design, which are resharpened by grinding the full length of the tool on the cutting face side; this does not change the form of the cutting end or the length of the tool. Thus it is a comparatively simple matter to reset the tools for duplicate work by means of a centering gage and dial indicator reading to 0.0001 inch, mounted on the turret carrier arm, as shown in Fig. 3.

The turret carrier arm is supported on a slide which moves horizontally and parallel to the axis of the machine spindle to provide longitudinal feed for the turret tools. This feeding movement is spring-actuated, and is controlled by a single cam, shown on the right-hand end of the camshaft at the front of the machine in Fig. 1. Adjacent to this cam is a second cam which transmits a pivoting movement to the turret carrier arm to provide the required transverse feeding movements for the tools. The ratio of cam rise to the movement of the turret-slide can be quickly adjusted for 1 to 1, 2 to 1, 3 to 1, and 4 to 1 ratios. Provision is made for moving the

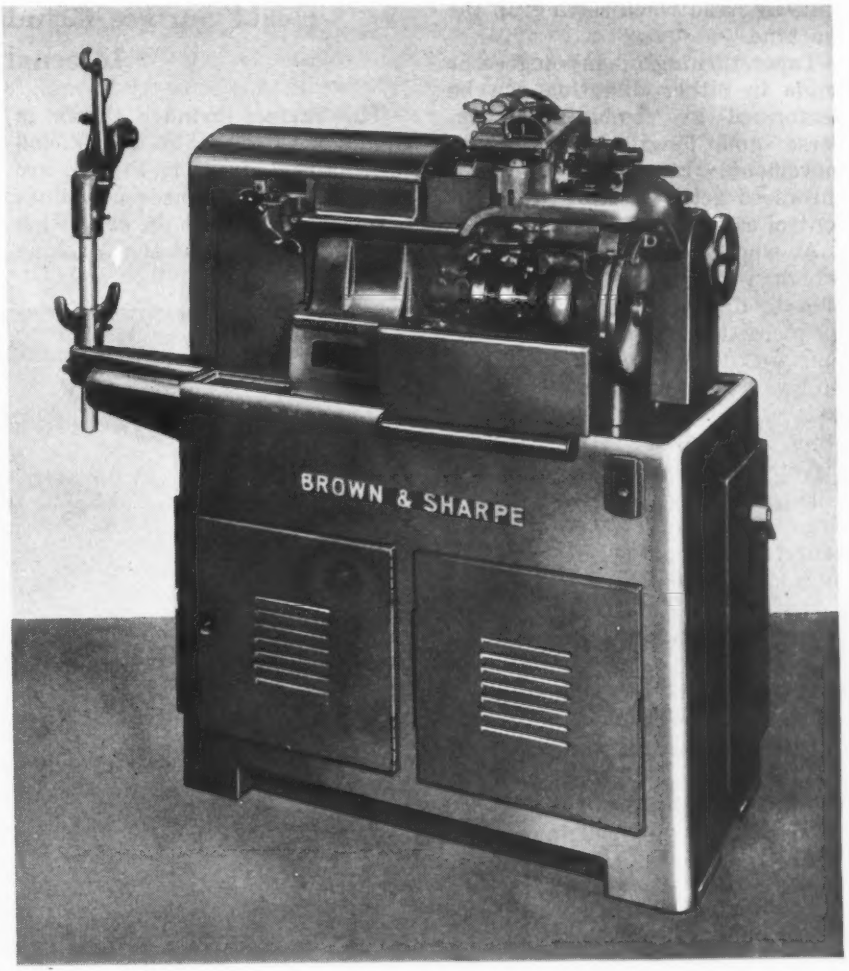


Fig. 1. Automatic Pinion and Staff Turning Machine Brought out by the Brown & Sharpe Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 220.

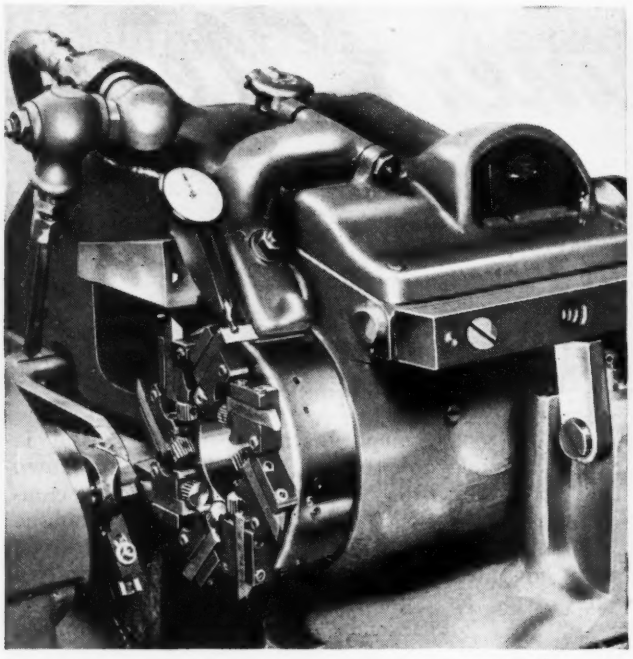


Fig. 2. Close-up View of Eight-position Tool Turret and Tool-adjusting Dial Indicator on Swinging Arm, which Assures Accurate Duplication of Original Tool Settings on the Machine Shown in Fig. 1

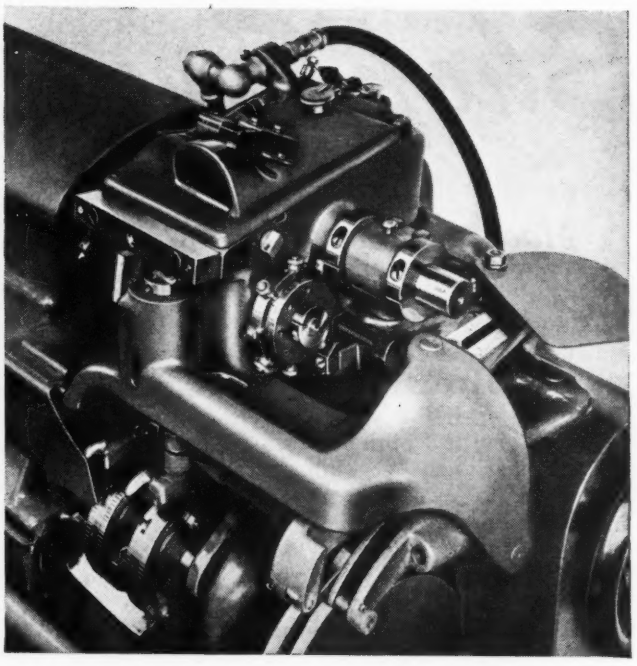


Fig. 3. View Showing Micrometer Stops for Tools and Disks Carrying Dogs which can be Set to Graduations for Duplicating Any Desired Turret-indexing, Collet-actuating, and Stock-feeding Operations

slide by hand when setting up the machine.

Taper turning of any degree or angle in either direction can be performed by combining transverse and longitudinal feeding movements controlled by synchronized action of the two feed-control cams.

A work deflector is provided which swings into position to direct the cut-off pieces into the work pan in the machine table. This deflector swings aside to permit chips and oil to fall directly into the tank during cutting operations. Operation of the deflector is controlled by a dog on the graduated carrier at the front of the machine.

Automatic forced-feed lubrication of the spindle and of other important bearings of the machine is provided by a mechanical oiler. An ample flow of coolant from the reservoir is furnished by a geared pump. The machine weighs approximately 1350 pounds, and occupies a floor space of 39 by 66 inches.....61

Heald Surface Grinders, Bore-Matics, and Internal Grinders

The surface grinder shown in Fig. 1, the Bore-Matic, Fig. 2, and the internal grinder, Fig. 3, are representative of three new lines of machines placed on exhibition for the first time at the Machine Tool Show by the Heald Machine Co., Worcester 6, Mass. The hydraulic equipment of these machines has been designed to operate uniformly, regardless of changes in oil temperature. This new feature insures the maintenance of maximum output and the best possible finish and accuracy without requiring constant adjustment of the feeds. A large variety of operating cycles is obtained from the same standard units through conveniently positioned controls. Set-up time has been greatly reduced by the provision of instruction plates and graduated control knobs.

Fig. 1. Front View of New Surface Grinding Machine Built by Heald Machine Co.

The motor and pump mountings have been separated from the machines to avoid the transmission of vibration, as well as to keep warm oil out of contact with the machine base. Improved idlers, cylinders, automatic

To obtain additional information on equipment described on this page, see lower part of page 220.

way lubrication, and refinements in hydraulics have been developed to give the smooth table motion necessary for high finishes, which are further improved by the greatly increased structural rigidity of the new machines.

New wheel-heads, work-heads, and boring heads are permanently lubricated and sealed to save the time formerly required for lubrication, as well as to save lubricating oil. These units are said to run surprisingly cool, the rise in temperature having been reduced approximately 50 per cent. Other features designed to simplify and reduce maintenance are improved ring type cylinders; steel piping with flare fittings; valves mounted on plates and removable without disturbing pipes; accessible self-adjusting brakes; and hydraulic power units that can be rolled out of the machines for inspection.

The wheel-spindle of the new Heald surface grinder is carried on a column, and the chuck table rests solidly on the ways of the base. With this construction, the ways are well covered, the overhang is small and constant, and the wheel pressure cannot lift the ram. The chuck is belt-driven. These machines can be furnished for automatic grinding cycles.

The vertical slide that carries the grinding wheel is mounted in protected anti-friction bearings to insure rigidity and accurate feeding. The chuck has a variable-speed drive furnished by a hydraulic motor. Table dogs are of the quick-setting type with micrometer adjustments. Power rapid traverse is provided for the wheel-slide and table. The wheel-spindle runs in automatically lubricated rocker-shoe bearings.

The major features incorporated in the new Bore-Matic include elimination of swinging latches to avoid danger of a latch "hanging up" and allowing the table to run past the normal reversing position, thus causing accidents; exceptionally fast table traverse, which can be accelerated while the table is traversing; large belt idlers designed to increase the life of V-belts; reverse dog and positive stop, which can be adjusted as one unit; hand control release of the brake when adjusting tools; improved hydraulic system which circulates only the amount of oil needed, keeping it at exceptionally low temperature; equipment for two-way boring, with different feeds in two directions if desired; and low table designed for convenient loading. Although originally designed for finish-boring, Bore-Matics are now used largely for turning, facing, milling, chamfering, etc., as well as for boring. Parts are thus roughed and precision finished at the same setting, with considerable saving in time, especially when several spindles are used.

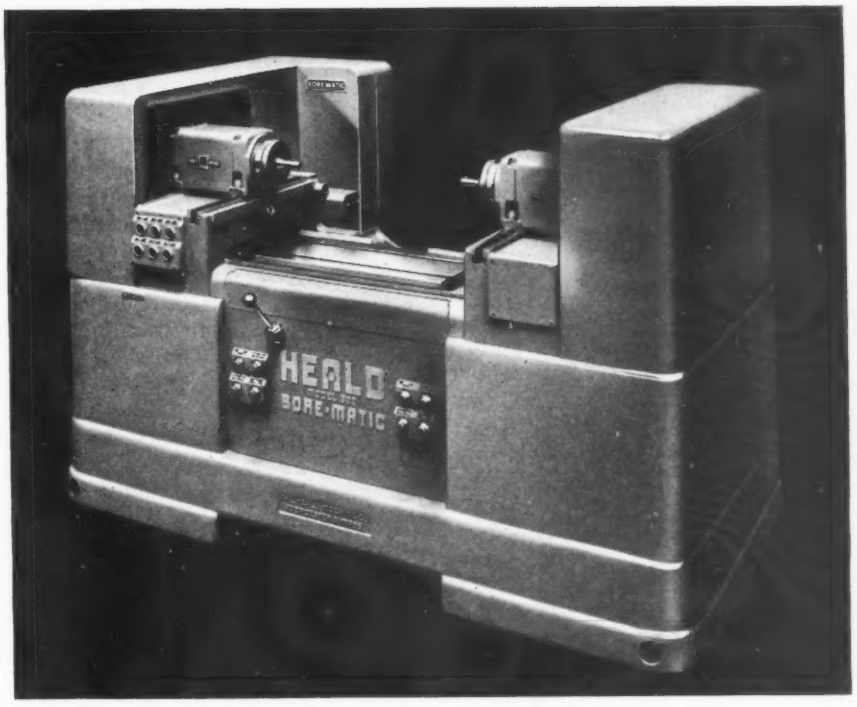


Fig. 2. Heald Bore-Matic of New Design

Some of the outstanding features of the new Heald internal grinder are high-frequency wheel-heads, which are capable of run-

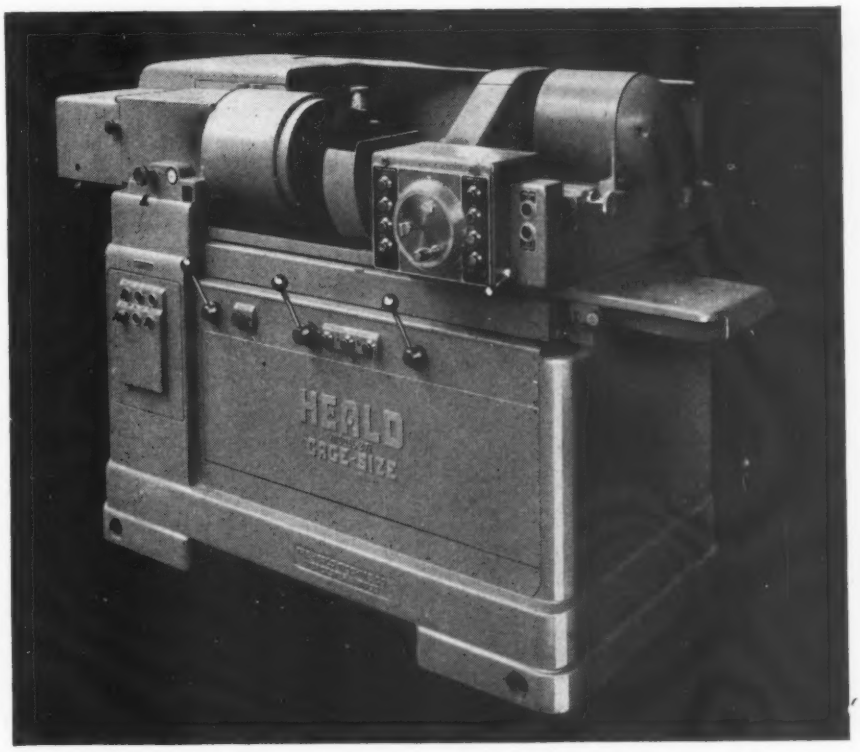


Fig. 3. Front View of Heald Internal Grinder

To obtain additional information on equipment described on this page, see lower part of page 220.

ning at very high speeds and taking heavy cuts; new feed mechanism, so arranged that the roughing and finishing rates of feed, the length of roughing and finishing strokes, and the amount of retraction, compensation, and rapid approach are set by graduated knobs on the feed-box; protected anti-friction ways, which give maximum rigidity to the cross-slide, as well as freedom from clamping and sticking, and insure accurate feeds; an indicator which shows when belt tension is correct for size of wheel-head used; and compact sealed wheel-truing unit.....62

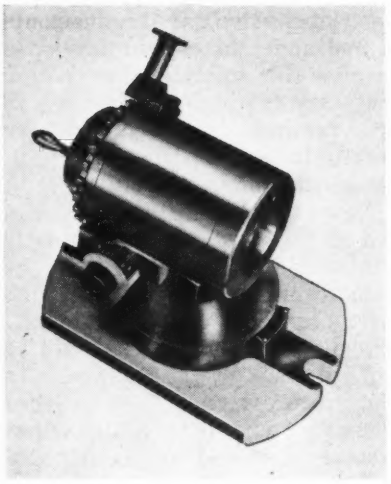
Baker Hydraulic-Feed Vertical Drill Press

A new vertical hydraulic-feed drill press with a wide range of spindle speeds obtained through belts and pick-off gears was among the new machines displayed by Baker Brothers, Inc., Toledo 10, Ohio, at the recent Machine Tool Show. This machine is provided with a separate hydraulic sump having quick connections for rapid replacement of the pump unit....63

Westinghouse Selenium Power Packs for Direct-Current Motors

A selenium rectifier power pack that makes possible the operation of direct-current motors from alternating-current service lines is a recent development of the Westinghouse Electric Corporation, 306 Fourth Ave., Pittsburgh 30, Pa. Simplicity is an outstanding feature of these power packs, their construction involving only the selenium rectifier, transformer, alternating-current contactor, and cabinet. They can be located off the floor, out of the way, no special foundation being required for their installation. Periodic inspections are sufficient, as the only rotating parts are the fan and motor on the 7 1/2- to 15-H.P. size units.

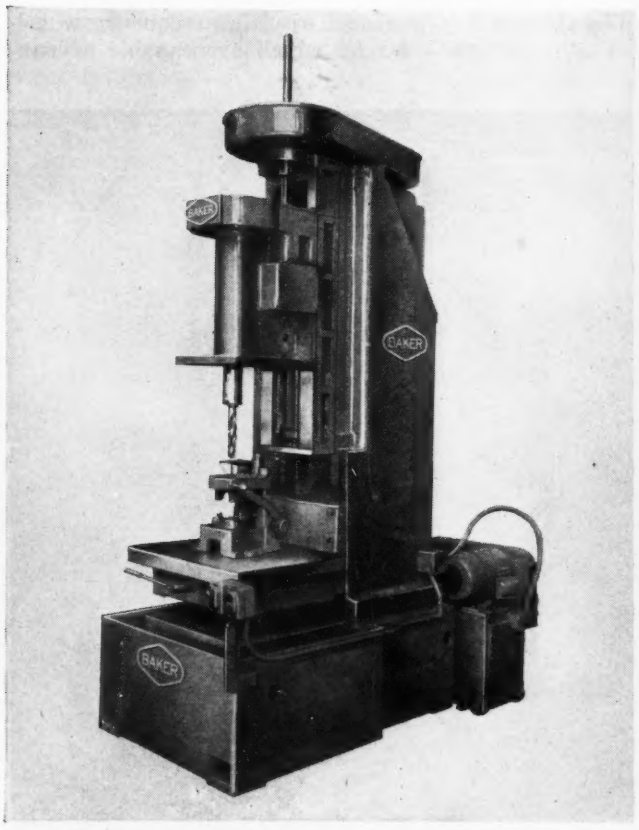
The power factor from 40 per cent load to full load is 95 per cent or better. Efficiency of the rectifier alone is 80 per cent for the self-cooled units and 72 per cent for the fan-cooled type. These power packs are available in seven ratings from 1 to 15 H.P. for conversion of three-phase alternating current. 64



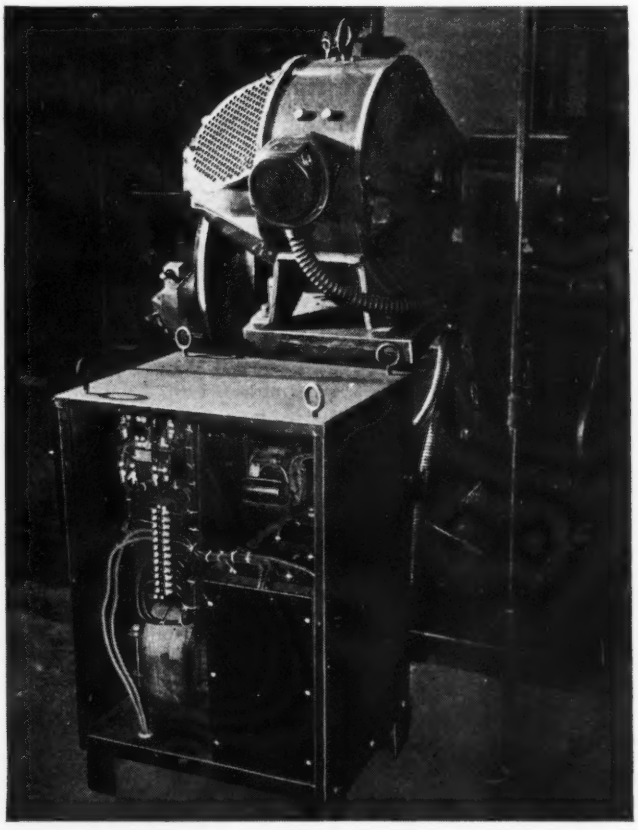
Universal Dividing Collet Head Made by Matco Tool Co.

Matco Universal Dividing Collet Head

A universal dividing collet head designed for use on both grinding and milling operations is a recent product of the Matco Tool Co., 2834 W. Lake St., Chicago 12, Ill. The new collet head has a sturdy graduated base, precision needle bearings, and a hardened and ground index-plate.



Baker Vertical Drill Press Equipped with Hydraulic Feed



Westinghouse Selenium Rectifier Power Pack for Direct-current Motors

To obtain additional information on equipment described on this page, see lower part of page 220.

It is 5 3/4 inches high, and will take ground thread collets in capacities up to 1 inch. Felt seals are provided to protect the head from dust.

Applications of this collet head include angular, flat, and hexagonal milling and grinding work. By means of attachments, it can be employed for grinding work on external grinders and for sharpening plain milling cutters, side mills, and the teeth of end-cutting mills. This collet head can also be employed for forming grinding wheels to the required radii and angular shapes with a dressing diamond. 65

Benchmaster Automatic Roll Feed for Presses

An automatic friction roll feed for presses has been brought out by the Benchmaster Mfg. Co., 2952 W. Pico Blvd., Los Angeles 6, Calif. This feed can be applied to both old and new types of Benchmaster punch presses, as well as to the majority of standard punch presses of other makes. It can be used for feeding metal, wood, plastic, cardboard, and felt materials.

The friction drive is geared down to provide a feed range of 0 to 3 inches, but a longer feed can be obtained if desired. It will take stock up to 3 inches in width, and can be adjusted for different thicknesses within a range of 0 to 3/16 inch, in increments of 0.001 inch, by means of a spring-loaded housing. The height adjustment is 0 to 2 1/4 inches. The machine can be operated at 285 strokes per minute, and the rollers can be fed forward or backward.

Other features include adjustable brake; simple two-bolt installation which permits changing the feed from the front to the side of the press; and hardened and ground friction rolls, 2 1/4 inches in diameter. 66

Press Equipped with Benchmaster Automatic Roll Feed

Snyder Automatic for Machining Intake Manifolds and Automatic Connecting-Rod Balancing Machine

Drilling, spot-facing, chamfering, and combination drilling and tapping operations can be performed on cast-iron intake manifolds at the rate of 160 pieces per hour, as shown in Fig. 1, on a special automatic machine built by the Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. High-speed steel tools operating in special Snyder hydraulic units with individual electric motor drive are employed for this job. The work cycle consists of load, index, rapid approach, feed, and rapid return. All of these

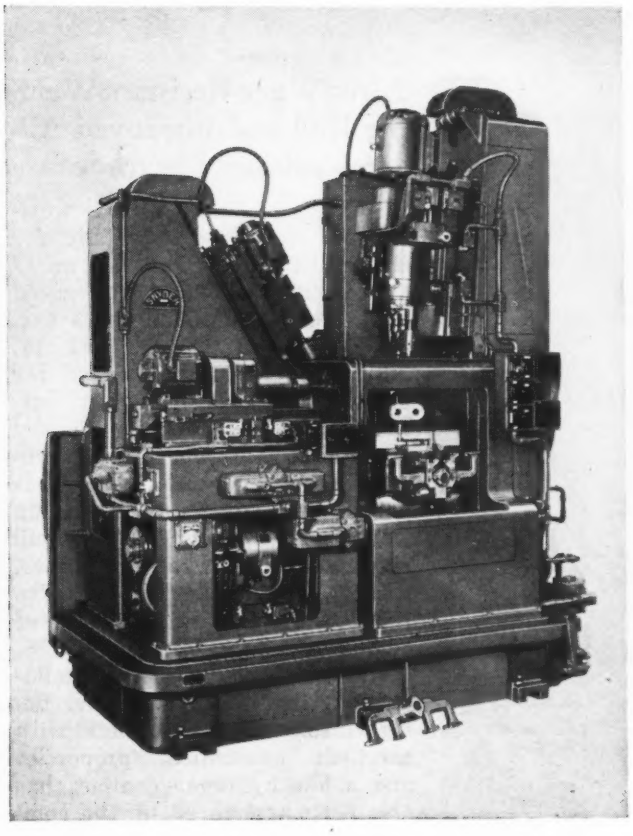


Fig. 1. Snyder Automatic Equipped for Machining Intake Manifolds

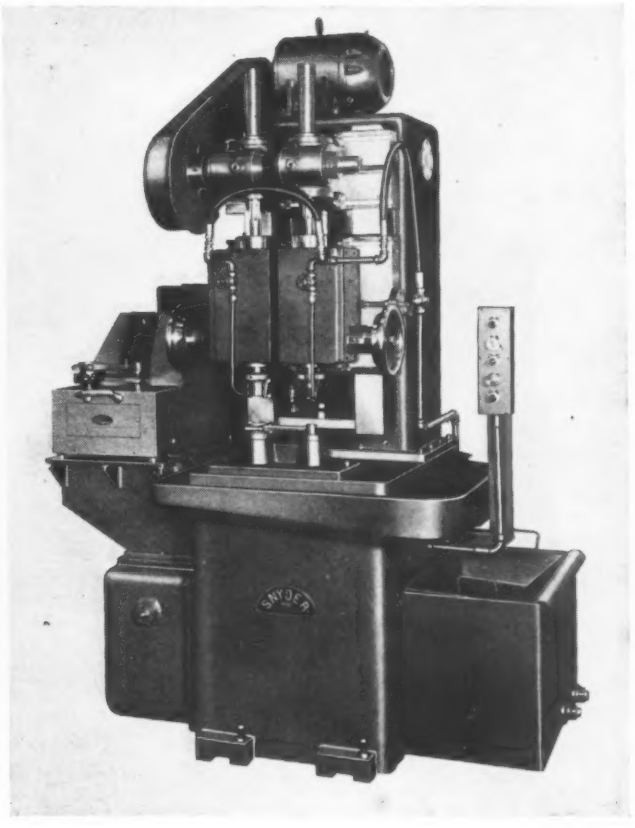


Fig. 2. Special Automatic Balance-milling Machine for Connecting-rods

To obtain additional information on equipment described on this page, see lower part of page 220.

operations, except loading, are performed in a completely automatic cycle.

The hydraulic work units are mounted on an automatic indexing table having four stations, the parts being clamped manually with quick-acting cam mechanisms. A safety stop-button is provided on the control panel. As the parts are of cast iron, no coolant is required.

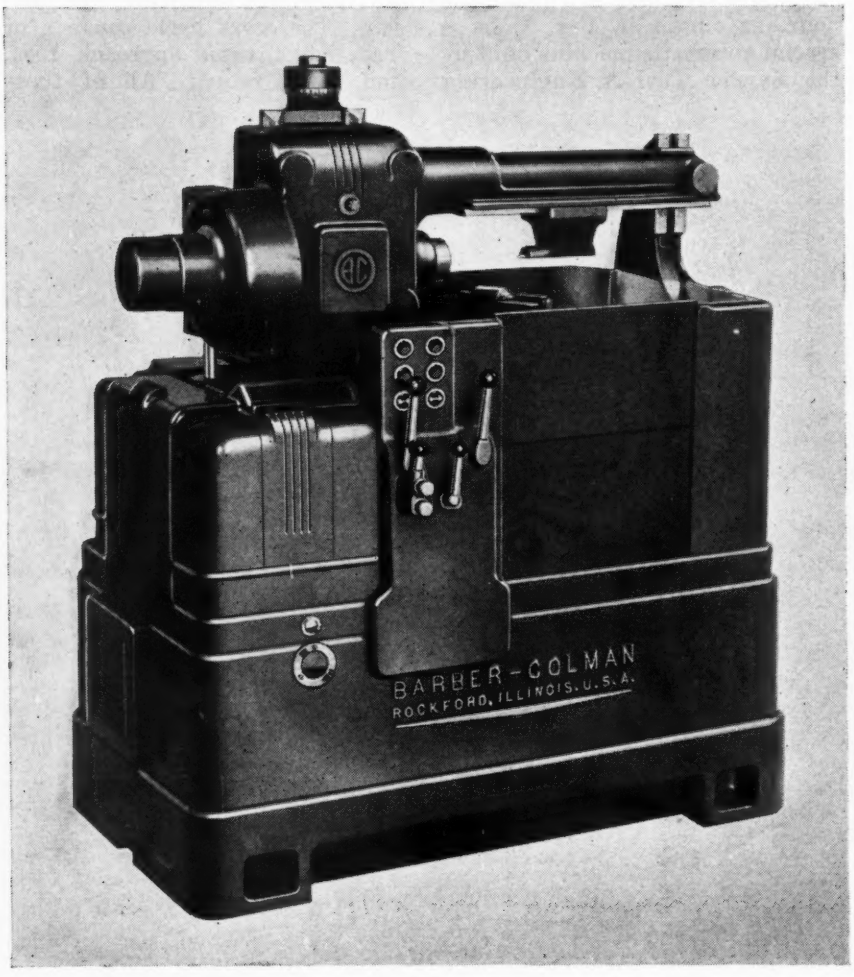
Greater efficiency and lower unit costs in balancing connecting-rods are objectives of the special Snyder balance-milling machine shown in Fig. 2. With the exception of setting the quills for depth, the operation of this machine is completely automatic and easily within the scope of unskilled operators. The parts are simply weighed on integral scales, the machine set for the proper depth of cut according to the predetermined weight-depth ratio, after which the parts are milled on one side in an automatic cycle with inserted-blade high-speed steel cutters and then turned over in the fixture and machined on the other side. The complete machining cycle consists of load, rapid advance, feed, and rapid return. Two sixteen-second machining cycles are required for each connecting-rod, exclusive of loading and weighing. Clamping of the work is automatic. The large milling cutters rotate at a speed of 55 R.P.M., and the small cutters at 110 R.P.M. One 5-H.P. 1800-R.P.M. motor is required for the spindle drive, and one 2-H.P. motor for the hydraulic pump.....67

Barber-Colman Hobbing Machine

The Barber-Colman Co., 109 Loomis St., Rockford, Ill., has brought out a new hobbing machine which was exhibited for the first time at the Machine Tool Show in Chicago. Outstanding features of this machine include semi-automatic cycling; speed adapted for carbide hobbing; conventional and climb hobbing in either direction; rapid traverse in either direction; and over-all design developed to facilitate operation, servicing, and maintenance. The machine is constructed in unit assemblies, with hardened and ground vee and flat ways on the horizontal bed and a one-piece over-arm index worm-gear case, and work-slide.

Semi-automatic operation of this machine is employed for the ordinary run of work, but once the initial set-up is made, the operator merely loads and unloads the work and pushes the cycle lever. For high-production runs, magazine loading can be used to obtain completely automatic operation.

The machine handles work up to 8 inches in diameter on some pitches, and has a hob slide travel of 12 inches. The maximum tooth form that can be hobbed under the most favorable conditions is 10 diametral pitch. The maximum size hob is 2 1/4 inches in diameter. Standard machines have spindle speeds from 150 to 1350 R.P.M., and feeds per revolution of the work from 0.005 to 0.400 inch.....68



Production Hobbing Machine Placed on the Market by the Barber-Colman Co.

Airco Wear-Resistant Welding Rod and Improved All-Position Electrode

A wear-resistant bronze welding rod developed especially for use in the railway field, known as "Airco 28," has been announced by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. This rod is designed for building up wear-resistant surfaces that are subject to heavy loads, especially where high temperatures are encountered. It is particularly suited for building up worn piston-heads, valve bull rings, driving-box laterals, shoes, wedges, and similar parts. The rod has an average hardness of 86.5 on the Rockwell B scale.

An improved all-position mild-steel "Airco 312" electrode, designed to produce weld metal with excellent mechanical properties and a low hydrogen content, has also been announced by the company. This electrode is said to have two advantages over its predecessor described on page 209

To obtain additional information on equipment described on this page, see lower part of page 220.

of April, 1946, MACHINERY. It can now be used on alternating and direct reverse-polarity currents, and requires no preheating to obtain porosity-free welds. Deposits can be obtained by stringer-bead or full-weave technique.

This electrode is intended for welding high-sulphur, free-machining steels; hardenable steels where no preheat is used; cold-rolled steels; and weldments that are to be vitreous enameled after welding.....69

Cincinnati "Projecto-Form" Grinding Machine

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has brought out a new machine known as the "Projecto-Form" for profile grinding operations on extremely accurate small formed parts. This machine, as its name implies, provides an optically enlarged image of the work, which can be compared, as the grinding progresses, with a previously prepared, enlarged-scale master drawing. Thus the machine serves the dual purpose of a profile grinder and an optical comparator.

A powerful lamp bulb and a set of condenser lenses focus a brilliant flood of parallel light rays across the top surface of the work. On the opposite side of the work, and having the work in its plane of focus, is an extremely precise optical projection lens system, which throws a greatly magnified silhouette image of the work profile on a ground glass viewing screen. The screen image corresponds exactly to the work profile as viewed from the operating position, without inversion or transposition. This arrangement prevents confusion in the positioning of work or grinding wheel. Standard equipment provides a magnification of 20 to 1, but a magnification of 40 to 1 can be had on special order.

The master drawing, consisting of an enlarged true-scale duplicate of the desired work profile is mounted behind, and in contact with, the ground glass viewing screen to permit comparison with the projected image. The projection unit is completely enclosed in a light-tight hood to maintain a brilliant screen image. The work is properly positioned in relation to the optical system by means of longitudinal, transverse, and vertical slides, and a swivel movement of the work platen provides for angular adjustment.

A precision measuring attachment consisting of an adjustable micrometer barrel support bracket, micrometer barrel, and dial indicator for each slide is available for work that requires accurate adjustments of the transverse and vertical work support slides. The grinding wheel is carried on transverse and vertical slides to provide for adjusting it in relation to the work.

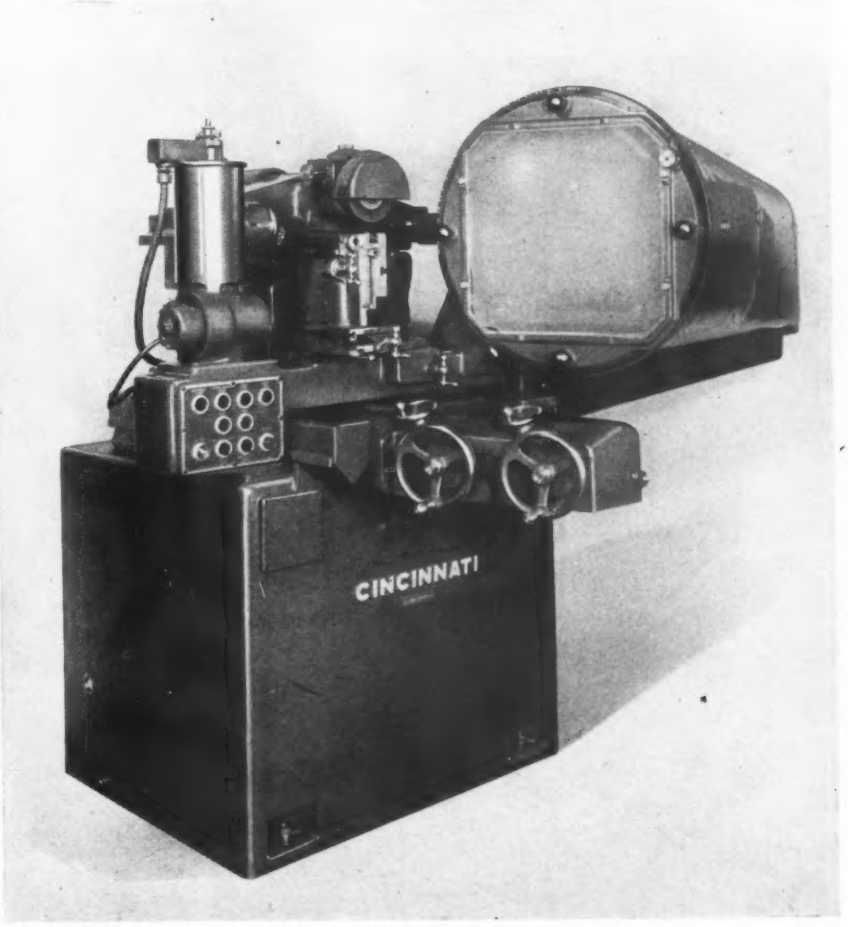
The wheel-head is mounted on a slide which provides longitudinal reciprocation of the wheel parallel to the optical axis of the projection system. This reciprocating movement is accomplished by a hydraulic cylinder and piston. The stroke length is adjustable and the speed of the stroke in each direction is infinitely variable.

The slide in which the wheel-head reciprocates is carried in a double trunnion type mount to permit angular adjustment of wheel reciprocation in both horizontal and vertical planes. This provides a means for grinding end and side clearances of cutter teeth or punches without changing the position of the work in relation to the optical system.

For jobs requiring the grinding of circular form tools or for formed circular parts a power-driven circular grinding attachment is available. This attachment is mounted on the face of the work-holding platen. 70

Sun All-Petroleum Cutting Oil

A new all-petroleum cutting oil developed to increase productivity and to lower operating cost has been brought out by the Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa. Longer tool life and improvement in finished surfaces of machined work are said to



"Projecto-Form" Grinding Machine Brought out by the Cincinnati Milling Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 220.

have been obtained in testing cutting oils made with a new ingredient known as "Petrofac." "Petrofac" cutting oil is made entirely from petroleum, and will not turn rancid or support bacterial growth.

Both high-speed automatic machines and extremely heavy-duty equipment are said to operate more efficiently and with fewer stops for tool resharpening when using this new cutting oil. 71

Landis Vibration Type Loading Device for Feeding Small Parts to Centerless Grinders

A unique loader or work-feeding device developed by the Landis Tool Co., Waynesboro, Pa., for its centerless grinding machines employs vibration for aligning screw blanks or similar parts and introducing them into the machines. There are no mechanically moving parts in this device other than those for set-up adjustment. Hence, wear due to friction is confined to the contact surface between the blanks and the hopper. The action of the blanks in the hopper is unique in that they move up a circular, inclined ramp on the inside of the hopper wall until they enter the feed-tube at the top of the hopper. The ramp extends around the inside of the hopper for one and one-half turns, providing a relatively long travel, which aids in aligning the blanks before they enter the feed-tube.

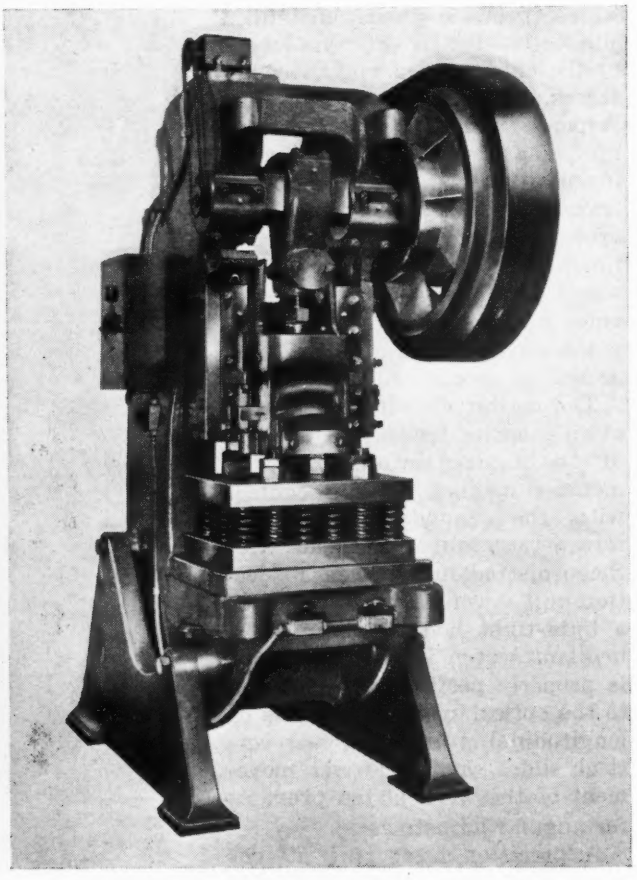
The clockwise movement of the blanks in the hopper is obtained through directional vibration by utilizing one-half of the sine wave of a rectified alternating current. A rheostat knob on the front panel provides means for adjusting the rate of feed. The loader readily handles blanks in which the length is equal to the diameter. Four hoppers, each handling three sizes of blanks, cover a range of sizes up to 5/8 inch in diameter. Removal of only two screws facilitates the changing of hoppers and the loosening of two screws permits the feed-tube to be changed. The mounting bracket can be readily adjusted for aligning the feed-tube with the grinding throat, as well as to permit the loader to be pivoted away from the machine. 72

Friction Clutch and Brake Developed for Cleveland Inclinable Press

A new air-operated drum type friction clutch and brake, designed for quick starting and stopping, has been brought out by the Cleveland Punch & Shear Works Co., Cleveland 14, Ohio. This equipment has been designed for use on inclinable presses of this company's manufacture, and can be readily applied to any sized new or old press, of either the flywheel or back-geared type. In all installations, the clutch and brake unit is mounted directly on the drive-shaft.

This clutch and brake, on which patent applications have been filed, has about one-half the number of parts and one-fourth the weight of a conventional type disk friction

Landis Vibration Type Work-feeding Device for Centerless Grinding



Cleveland Inclinable Press Equipped with New Drum Type Friction Clutch and Brake

To obtain additional information on equipment described on this page, see lower part of page 220.

clutch. These characteristics make possible quicker starting and stopping as well as a reduction in power consumption. The clutch is self-adjusting and is so arranged that it can be readily serviced without removal from the press. Admission of air to the operating cylinders causes the clutch to engage the flywheel, and release of the air causes the brake to be applied to the main shaft. Failure of the electric current or air supply simply causes the brake to bring the machine to an immediate stop. 73

Moore Diemaker's Try-Out and Assembly Machine

The trying out and assembling of dies — a time-consuming task for skilled toolmakers when done by hand—has been "mechanized" through the development of the "Die Flipper," announced by the Moore Special Tool Co., 734 Union Ave., Bridgeport 7, Conn. With this machine, one diemaker can easily perform all the operations of die assembling, including taking apart, turning over, drilling, tapping, and "trying out," which ordinarily requires the services of three or four skilled toolmakers. One man operating this machine can quickly test alignment, perform drilling operations with the punches in place, tap screw-holes, hand-stone, and make visual inspections.

The punch-holder and die-shoe are clamped securely to the machine, preventing pinching of fingers and dropping of heavy parts. The machine can be used to take apart and flip over a die set 20 by 40 inches in size, having a 12-inch shut height and pins that engage bushings for a length of 4 inches. It is so designed that the platen will hold the punch-holder parallel to the die-shoe under compression or tension at all times.

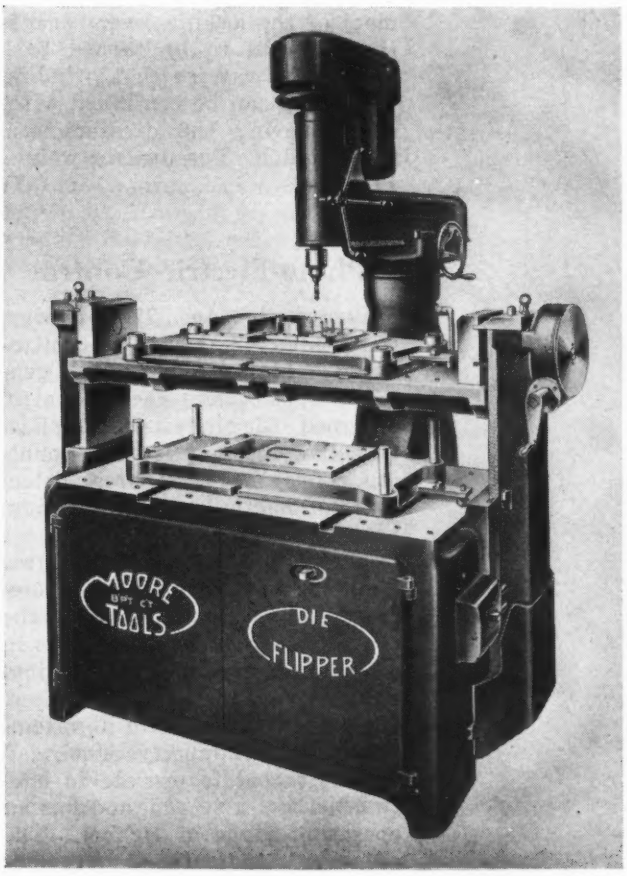
The machine will perform the important function of a radial drill in drilling angular or straight holes. It has a drilling speed range of from 200 to 1200 R.P.M., and will drill holes up to 1 1/2 inches in diameter.

The working surface of the base is 24 by 40 inches, and the platen surface is 14 by 40 inches. The platen has a vertical hand- or power-operated travel of 15 inches. It also can be rotated through a complete circle. 74

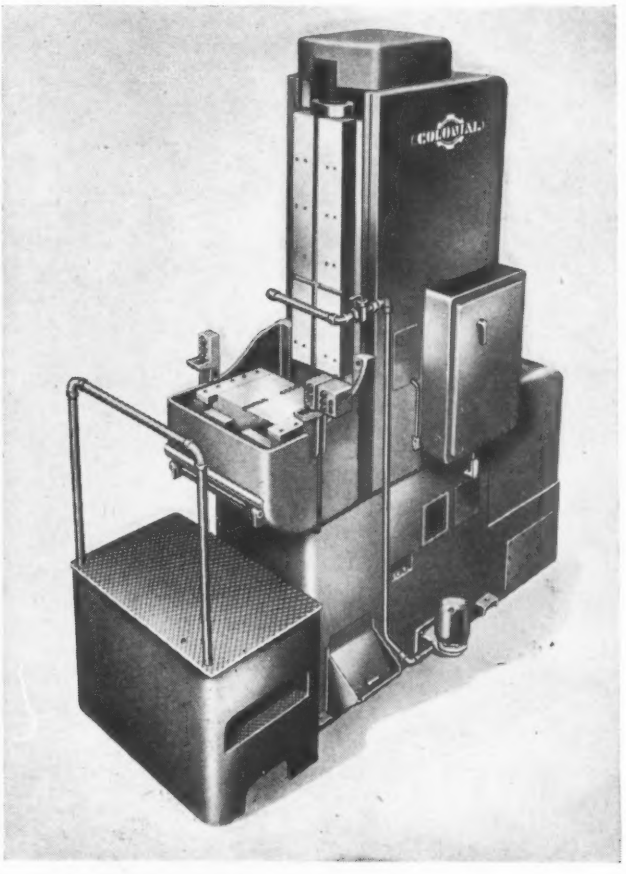
Colonial Broaching Machines

Three improved lines of broaching machines have been announced by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. The new lines consist of both pull-up and pull-down types, as well as a line of single-ram surface broaching machines of the design shown in the illustration. All machines are of the vertical type, and are built in a complete range of standard tonnages and strokes.

These machines have an entirely new hydraulic system lay-out. Hydraulic pumps are mounted outside of the machine housing, where they are accessible for adjustment, inspection, or ser-



Moore "Die Flipper" for Trying out and Assembling Dies



Single-Ram Surface Broaching Machine Built by Colonial Broach Co.

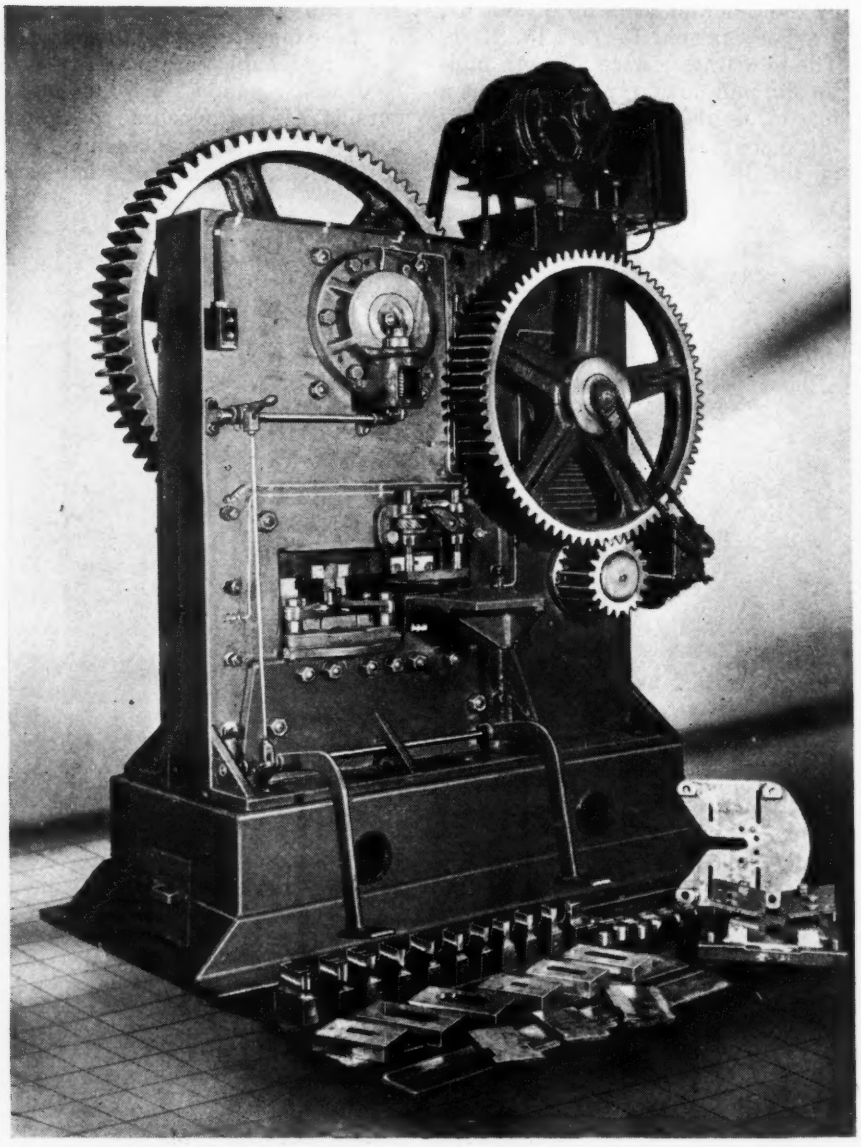
To obtain additional information on equipment described on this page, see lower part of page 220.

vicing. They are provided with a light-weight enclosure for protection. A new air-circulation system for the motors and hydraulic system provides adequate cooling, permitting high peak loads to be sustained without difficulty.

All valves are gasket-mounted with pressure seals, so that any valve unit can be individually removed without disturbing the piping or draining the system. Filters are accessible for inspection and cleaning while the machine is running. A large capacity hand-pump is provided for quick priming of the automatic lubrication system when starting the machine after a long idle period. Lubrication is provided by a high-pressure system with a self-priming pump. These machines are equipped with heavy-duty box type hardened and ground gibs.....75

Buffalo Machine Equipped for Punching and Shearing Locomotive Springs

The Buffalo Forge Co., Buffalo 5, N. Y., exhibited at the recent Machine Tool Show in Chicago a machine designed for cutting and punching locomotive and tender spring leaves, which has a capacity for cold-shearing 7- by 3/4-inch spring leaves. This machine can be operated at a speed of 22 strokes per minute. It is 6 feet 7 inches high by 6 feet wide by 6 feet 8 inches long. The weight of the machine is approximately 10,000 pounds. 76



Machine for Cutting and Punching Locomotive and Tender Spring Leaves

Erickson Grinding Wheel Dresser

Erickson "Tru-Matic" Wheel Dresser

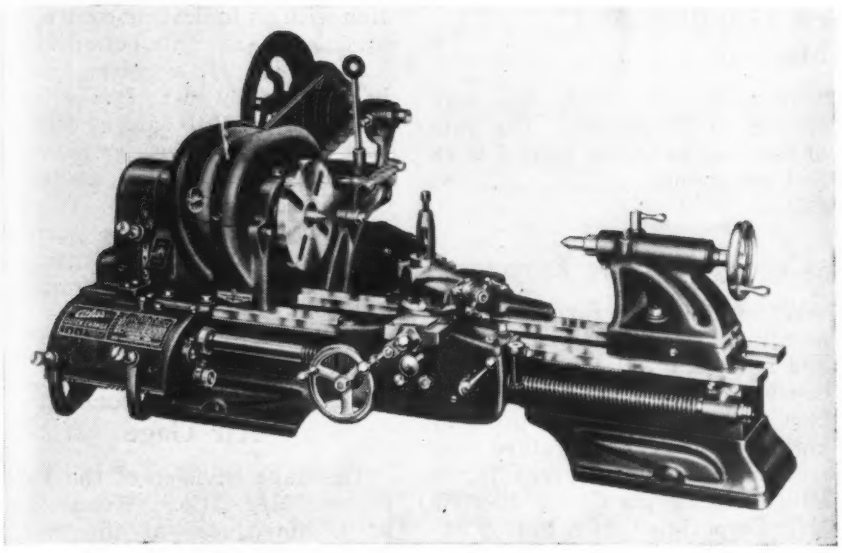
A precision grinding wheel dresser has been developed by the Erickson Tools Division, 2309 Hamilton Ave., Cleveland 14, Ohio, to reduce the set-up time for dressing the wheels of internal grinders. This dresser is designed to permit wheels to be dressed repeatedly in the same set-up without losing time required in resetting the wheel. A simple movement of the locking lever permits the diamond to be turned back out of the way, so that grinding operations can be continued without removing the dresser from the machine. The dresser weighs 17 pounds. 77

Photo-Electric Control

Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass., has introduced a high-speed, rugged, general-purpose photo-electric control designed for industrial application. It is recommended for counting, conveyor control, break detection, automatic weighing, sorting, gate signals, etc.

The photo-tube and light source lamp are in small dust-tight, die-cast housings, both wired to the control housing. The control is in a deep-drawn sheet-steel housing, and is designed to give long service under conditions of high temperature and humidity. The relay is constructed to operate in one-twentieth of a second, and has an operating range of 10 feet. The sensitivity adjustment provides for relay operation at any predetermined level of illumination within 10 to 50 foot-candles.....78

To obtain additional information on equipment described on this page, see lower part of page 220.



Atlas Lathe with Quick-change Gear-box

Atlas Quick-Change Lathes

A new line of low-cost 10-inch quick-change lathes designed to save set-up and operating time has been brought out by the Atlas Press Co., 2353 N. Pitcher St., Kalamazoo 13D, Mich. The quick-change mechanism of these machines provides instant finger-tip selection for fifty-four thread pitches and feeds, forty-five of which are obtained by merely shifting two levers on the gear-box. The additional nine changes are effected by adjusting the position of a sliding gear. The quick-change mechanism does not limit, in any way, the odd thread and feed range capacity of the lathes. The tumbler gear lever provides means for reversing the gears or disengaging them from the lead-screw. By varying the gear train with the available change-gears, hundreds of additional threads and feeds are obtained for special jobs, such as metric threading, coil and wire winding, and special tooling.

Other features of the new lathes include Timken tapered roller bearings, precision-ground bed, back-gears, instantly reversible power cross and longitudinal feeds, and rapid-change countershaft.

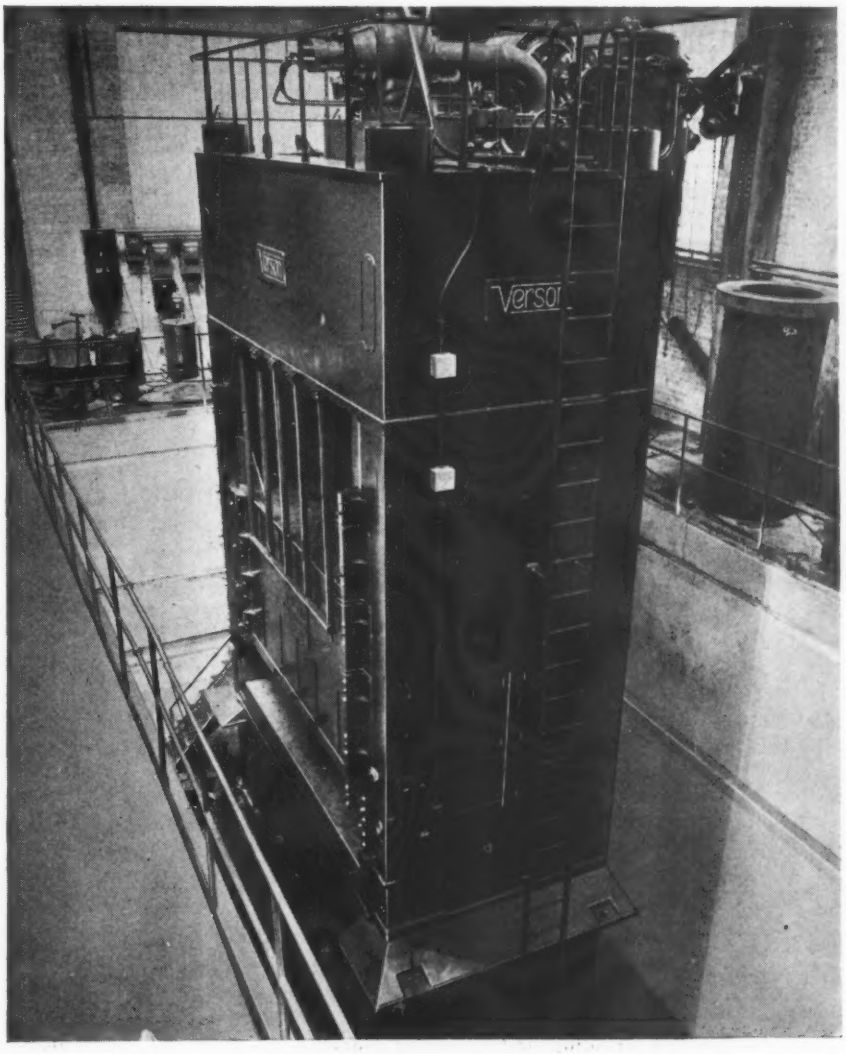
The swing over the bed is 10 1/4 inches, and over the carriage 6 5/8 inches. Sixteen spindle speeds ranging from 28 to 2072 R.P.M. are available. The thread cutting range for right- and left-hand threads is from 4 to 240 threads per inch. Two bed lengths are available having capacities between centers of 24 and 36 inches. The lathe is driven by a 1/3- or 1/2-H.P., 1725-R.P.M. motor. 79

Verson Hydraulic Press

The Verson Allsteel Press Co., 9309 E. 93rd St., Chicago 19, Ill., has announced the development of a 1500-ton straight-side hydraulic press. This huge press is 38 feet high, over 19 feet long and 10 feet wide. It has a stroke of 48 inches, with a daylight opening of 88 3/4 inches. The bed area is 96 by 144 inches, and the weight approximately 500,000 pounds.

Outstanding features of this press include fast advance to the work with automatic shifting to the full pressure stroke, arranged to eliminate high-speed impact; automatic reversal to suit the pressure or length of stroke required; and full electrical push-button control for automatic operation, with control stations provided for four operators.

The first press of this type completed is equipped for forming heavy parts for tractors. The die set weighs 74,000 pounds. 80



Mammoth Straight-side Hydraulic Press Built by Verson Allsteel Press Co.

To obtain additional information on equipment described on this page, see lower part of page 220.

Hammond Centerless Grinding and Polishing Machine

Hammond Machinery Builders, Inc., 1619 Douglas Ave., Kalamazoo 54, Mich., have added to their line of grinding and polishing equipment a centerless cylindrical grinder-polisher. This machine is designed for wet or dry grinding or polishing operations on rods, bars, and tubes from 1/8 inch to 1 1/4 inches in diameter.

The machine uses coated abrasive belts for grinding and polishing. Up to 0.005 inch of stock can be removed per pass of the work when grinding ferrous metals, and up to 0.010 inch when handling non-ferrous metals. The work supports will handle 1/2-inch bars up to 18 feet in length and 1-inch bars up to 8 feet in length. Production work can be held to limits of 0.001 inch.

The endless abrasive belt used on this machine is 4 inches wide, 60 inches long. Two methods of feeding are employed—through-feed and in-feed. The through-feed method is generally used, and is accomplished by swinging the regulating wheel on its horizontal axis from the zero setting to 12 degrees. The rate of feed can be varied from 0 to 18 feet per minute. 81

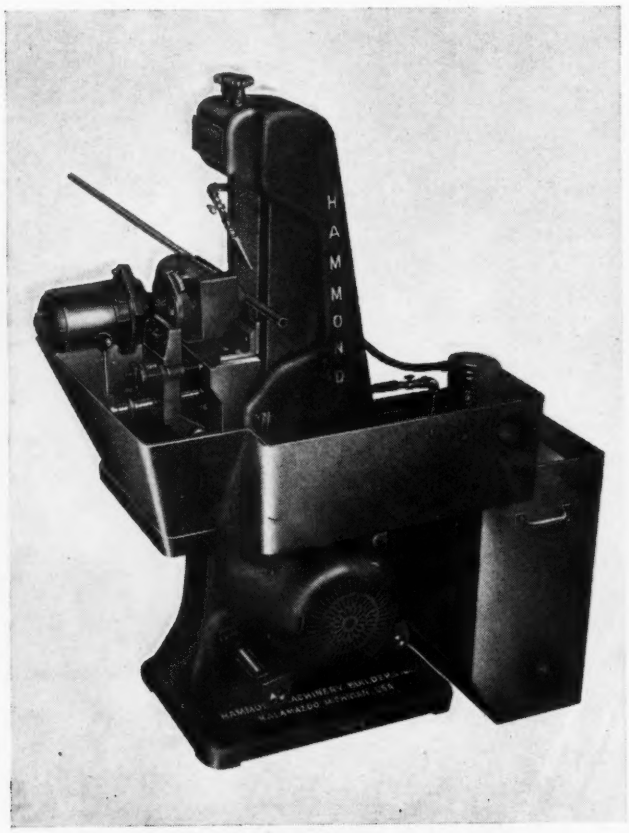
Cooley Electric Furnaces

A new electric furnace incorporating a selective power modifier and a vertical lift door, which is capable of continuous operation at 2000 degrees F. and provides highly accurate temperature control down to 300 degrees F., is announced by the Cooley Electric Mfg. Corporation, 44 S. Shelby St., Indianapolis 7, Ind. This new furnace is suitable for heating small parts, tools, and dies. Rapid and uniform heating of the 8- by 6- by 14-inch chamber is assured by six embedded type heating elements. The power capacity is rated at 4650 watts. Only 2 1/2 kilowatts are required to maintain the furnace at a temperature of 2000 degrees F.

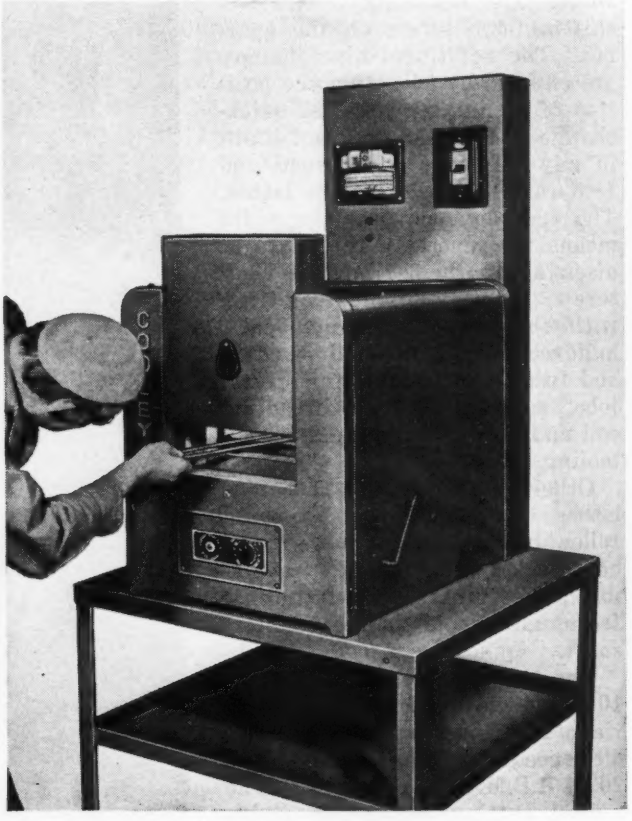
The furnace is equipped with the new Cooley selective power modifier. When used in combination with an indicating-controlling pyrometer, this unit permits critical temperature requirements to be successfully met. Power input can be adjusted to balance furnace heat losses, and low temperature overshooting of the pyrometer is eliminated. The modifier arrangement serves to prevent the furnace from running up to destructive temperatures in case of pyrometer failure. 82

Taft-Peirce Precision Air Gage

The Gage Division of the Taft-Peirce Mfg. Co., Woonsocket, R. I., introduced at the recent Machine Tool Show in Chicago a new self-contained streamline air gage known as the "CompAirator," which is 7 inches wide, 8 1/2 inches deep, and 7 1/2 inches high. Weighing only 12 pounds, it can be easily moved to the job for spot-checking and is especially designed to make possible faster and more economical inspection in the laboratory, at the bench, or at the machine. The housing of the gage contains an air filter and regulator.



Centerless Grinding and Polishing Machine Made by Hammond Machinery Builders, Inc.



Cooley Electric Furnace Equipped with Power Modifier and Vertical Lift Door

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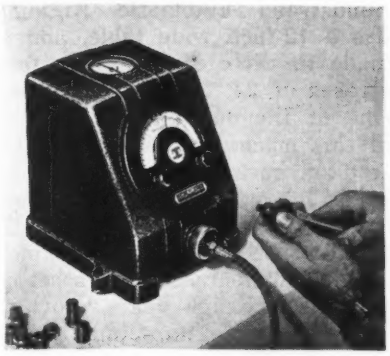


Taft-Peirce Precision Air Gage

It is only necessary to attach the air supply hose to the air line in order to make the gage ready for use. The gage measures the work without making mechanical contacts, and no special skill is required to operate it. All dimensional variations, such as taper, out-of-roundness, bell-mouth and barrel-shape conditions, can be easily checked. The gage combines the two advantages of a diaphragm-actuated dial indicator of high sensitivity and easy readability with the fast action of a velocity type air circuit. The 180-degree linear dial, graduated in increments of 0.00005 inch, provides accurate readings which are free from pointer flutter.

The gage has a magnification ratio of 2500 to 1, and operates on an air pressure of 30 to 60 pounds per square inch. Air consumption is less than 10 cubic feet per hour. 83

Sheffield "Projectoform" Grinder

The Sheffield Corporation, Dayton 1, Ohio, has announced a new "Projectoform" grinder in which many interesting and unusual features have been incorporated. The optical system of this profile grinding machine uses either contour or opaque projection with surface illumination and 25 to 1 or 50 to 1 magnification of the work and wheel. A prism incorporated in the optical system presents the image in a natural position with respect to the work, so that confusing opposite movements of the work and projected image are avoided.

All moving ways of the "Projectoform" grinder are completely sealed and provided with anti-friction bearings to insure firmness, rigidity, easy movement, and long life. Remote control of the wheel-head movement is accomplished hydraulically, allowing the operator to sit in a comfortable position in front of the projection screen while operating the conveniently placed micrometer control wheels. The highly amplified work and wheel are both shown on the screen in natural colors. 84

Press Designed for Riveting Electrical Rotor and Stator Laminations

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has built a 100-ton assembling press designed for riveting electrical rotor and stator laminations. This is a self-contained hydraulic machine having a platen area of 18 by 18 inches, a daylight opening of 32 inches, and a ram travel of 13 inches. Die cushions of 10 tons capacity are located in both the platen and the bed. 85

"Projectoform" Profile Grinding Machine Made by Sheffield Corporation

Riveting Press Designed for Assembling Rotor and Stator Laminations

To obtain additional information on equipment described on this page, see lower part of page 220.

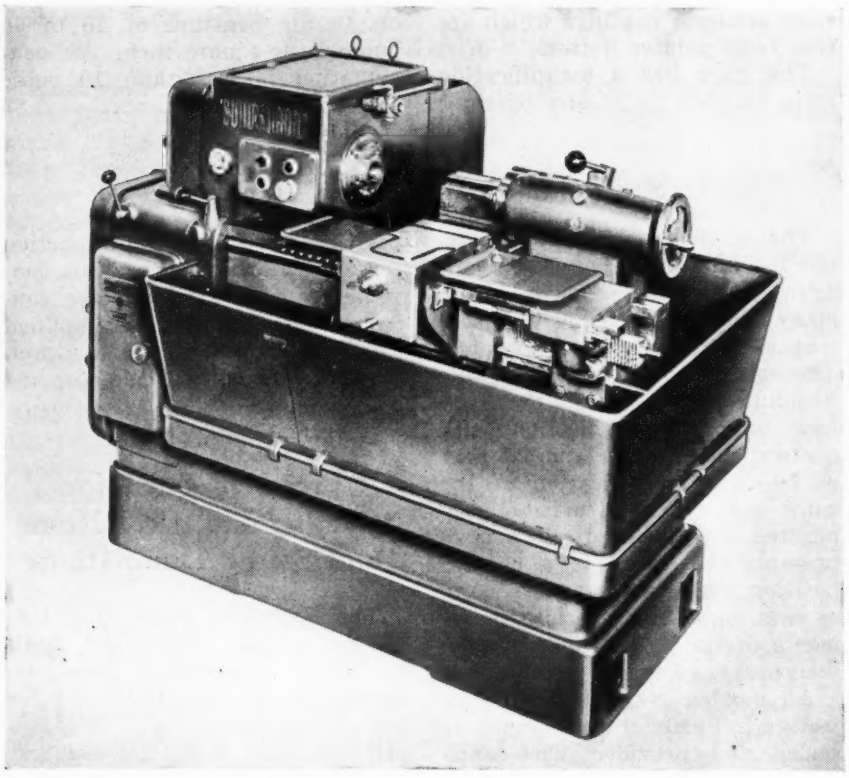


Fig. 1. Sundstrand Small-size Automatic Lathe

Sundstrand Automatic Lathe and Rigidmil

The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., placed on exhibition at the recent Machine Tool Show the Model 4 automatic lathe shown in Fig. 1 and the Model 22 Rigidmil illustrated in Fig. 2. The machine shown in Fig. 1 is a somewhat smaller model than any previously included in this company's line of automatic lathes. Like all Sundstrand automatic lathes, this new machine provides the opportunity to use multiple tooling and automatic cycling on short-run as well as long-run work. This is facilitated by providing an easy means of changing the machine cycle.

An outstanding feature of this machine is the wide range of speeds and feeds available. Spindle speeds are in a 60 to 1 ratio, and the front carriage feeds range from 0.0015 to 0.054 inch per revolution of the spindle. This enables the proper feeds and speeds to be employed for many different materials and cutting tools. A screw feed for the front carriage, automatic lubrication for all moving parts, and hardened and ground carriage ways and slides are also features of this machine.

The machine is designed primarily for fast, automatic multiple-tool cycle operation on small work. It will swing work up to 9 1/2 inches in diameter over the front and rear slides.

The new 7 1/2-H.P. Model 22 Sundstrand automatic Rigidmil has a 12-inch wide table, and is made in three sizes having feed strokes of 24, 36, and 48 inches. One of the outstanding features of this machine is the high-ratio feed and speed range. The spindle heads have an 80 to 1 ratio between the high and low spindle speeds. Speed changes are obtained by pick-off gears, and each set of two speed-change gears provides four changes. The spindle heads have independent motor drive through a 7 1/2-H.P. motor.

A mechanical feed-box with a 100 to 1 ratio between the high and low feed rate drives the table feed-screw. Four different rates of feed can be obtained with each set of two feed-change pick-off gears. The two standard feed ranges available are 1/2 inch to 50 inches and 1 inch to 100 inches per minute. The rapid traverse rate for the table is 300 inches per minute. The feed stroke and table cycles are controlled by easily adjusted dogs attached to the front of the machine table.

A vertical feed attachment is available for this machine as extra equipment. With this attachment, combined head and table movements make it possible to do square cycle or step milling. The machine is also available in a duplex model with either 36- or 48-inch feed stroke. 86

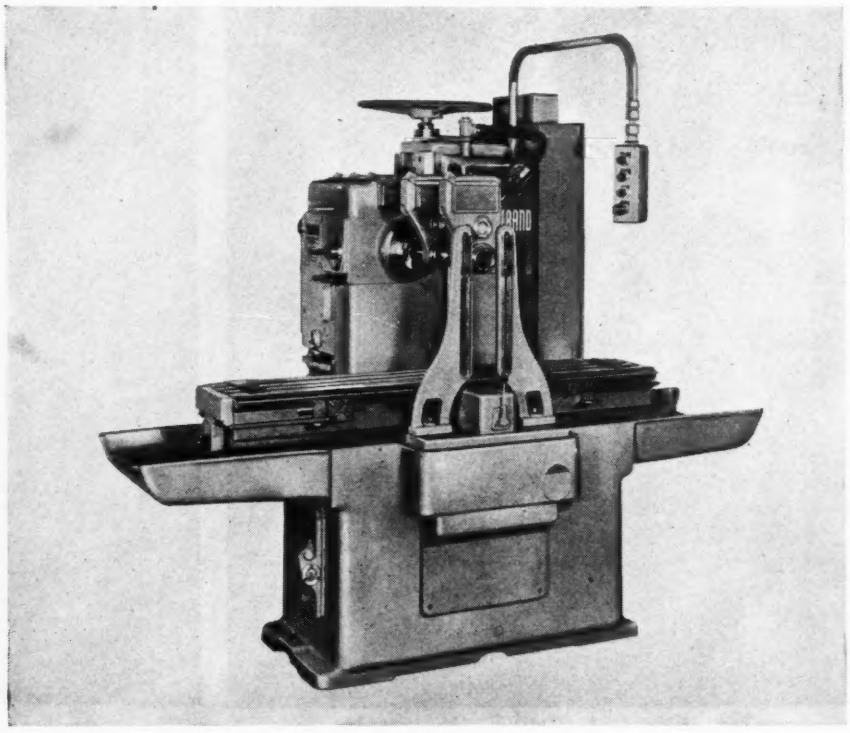


Fig. 2. Sundstrand Automatic Rigidmil with High-ratio Feed and Speed Range

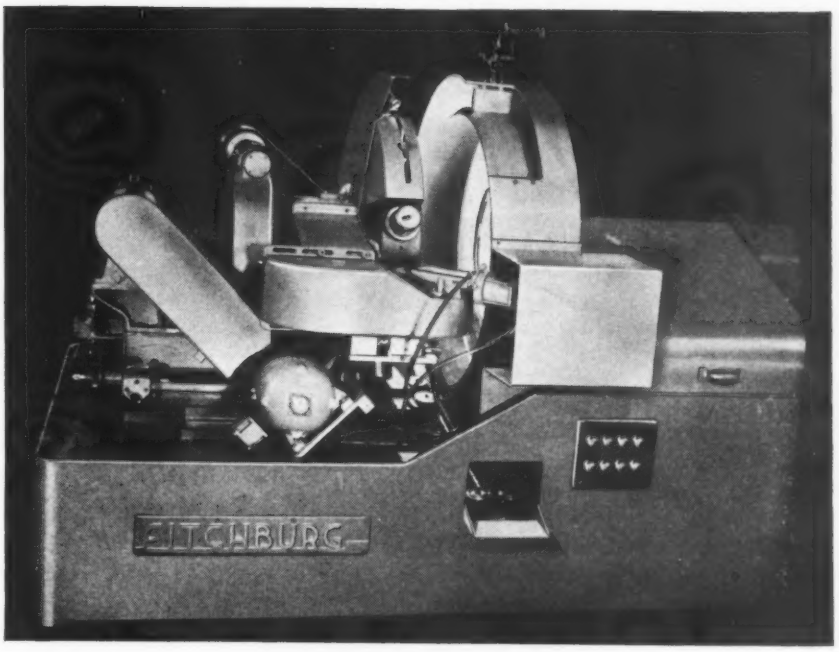
To obtain additional information on equipment described on this page, see lower part of page 220.

Cross Manifold Milling Machines

Two new power indexing type milling machines for machining engine exhaust and intake manifolds have been developed by the Cross Co., Detroit 7, Mich. The machines are designed to mill the stud clearances and the back of the mounting flanges to provide a uniform contact surface when the nuts and washers are assemblied. With this equipment, the production rate is ninety-three manifolds per hour. The machines are provided with hardened and ground steel ways throughout. All movements except clamping of the work are controlled by means of push-buttons.

Each machine has three stations, the first being used for loading and unloading the work; the second for milling the back of the flanges; and the third for form-milling clearances for the studs. All operations are performed simultaneously, so that one work piece is completed with each indexing movement.

The machines are designed to utilize Cross standard units, a No. 101 vertical column being used at the second station, while a No. 26 horizontal-head, hydraulic, way type feed unit is used for the third station. The power-driven 36-inch indexing table is also a standard Cross unit. 87



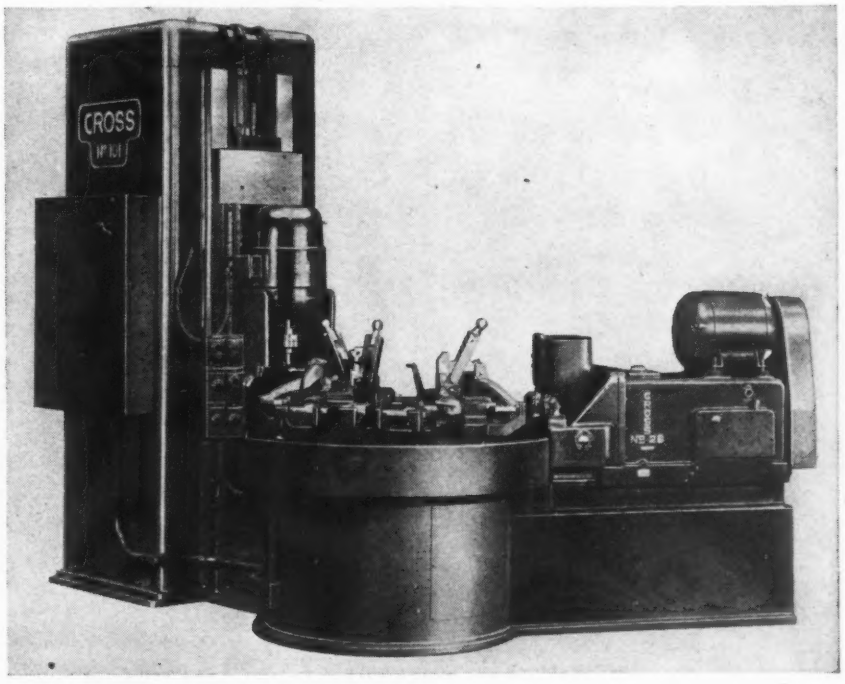
Fitchburg Valve-seat Grinding Machine

Fitchburg "Consta-Contac" Valve-Seat Grinder

A basically new method of cylindrical grinding called "Consta-Contac," in which three or more parts are in constant contact with a single grinding wheel, is used in an automatic valve-seat grinder developed by the Fitchburg Grinding Machine Corporation, Falulah Road, Fitchburg, Mass. The machine illustrated is equipped for grinding automotive-engine valve seats at the rate of 2160 per hour. Although the actual "sparking" time for a part is the same as in ordinary cylindrical grinding, the new method makes it possible to grind three parts in the time ordinarily required for a single part. Loading and unloading are automatic.

The valves are ground to size while being fed through a 90-degree sector of the wheel face. The machine comprises a belt-driven vertical grinding wheel and a vertical turret having twelve driving spindles designed to receive the valve stems. The quill type, self-contained spindles are rotated by a 1-H.P. motor through a friction drive. The turret is belt-driven by another 1-H.P. motor. The wheel rotates at a speed of 5000 surface feet per minute, and the valves at 80 to 110 surface feet per minute.

An automatic truing device, with self-contained compensation, allows dressing of the wheel with only momentary interruption of the loading operation. When desired, the grinding wheel can have both a coarse and fine cutting surface to take care of rough and finish grinding in one pass of the work. Also, the grinding wheel can be formed to grind several diameters and shoulders. A substitute method of holding work permits the use of short centers. 88



Cross Power Indexing Type Milling Machine for Milling Exhaust and Intake Manifolds

To obtain additional information on equipment described on this page, see lower part of page 220.

Presenting

THE NEW DESIGN "OOG" AND "OG" AUTOMATIC SCREW MACHINES

IMPROVEMENTS AND REFINEMENTS have been made in these Automatic Screw and Automatic Cutting-Off Machines to increase their efficiency and to permit the maintenance of closer limits, finer finish and more uniform production.

Spindle is positively driven at all speeds and is provided with 196 two-speed combinations including a wide range of high to low speed ratios. This wide selection of ratios makes possible the use of correct speeds for threading without limiting the selection of efficient high speeds for forming, drilling and similar operations. Equal cutting efficiency is obtained on all materials ranging from tough alloy steels to free-cutting plastics and on the widest range of work diameters.

Numerous design and construction details combine to shorten set-up time and a wide assortment of available attachments further increases overall value in terms of investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

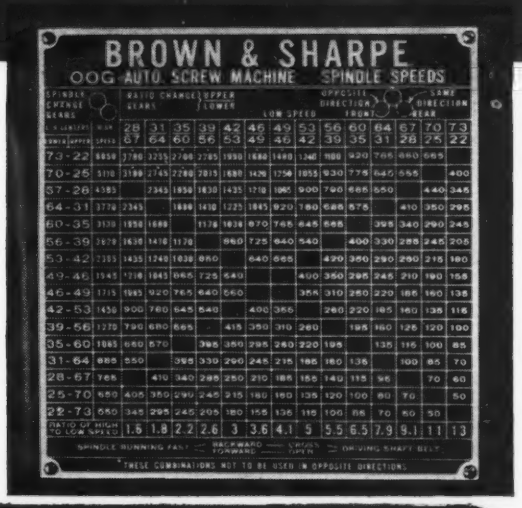
NO. OOG CAPACITY . . .
Takes stock to 3/8" diameter. Turning capacity to 3/4".

NO. OG CAPACITY . . . .
Takes stock to 5/8" diameter. Turning capacity to 1 1/4".

BROWN &

Featuring

196 two-speed combinations of spindle speeds with positive chain drive to spindle



BROWN & SHARPE

OOG AUTO. SCREW MACHINE SPINDLE SPEEDS

SPINDLE SPEED GEARS	RATIO CHANGE GEARS	UPPER / LOWER	LOW SPEED	OPPOSITE DIRECTION FRONT	SAME DIRECTION REAR
28 31 35 39 42 46 49 53 56 60 64 67 70 73					
67 64 60 56 53 49 46 42 39 35 31 28 25 22					
73-22 6050 5780 5235 4780 4585 4150 3880 3540 3280 2970 2685 2430 2195 1985					
70-25 5110 4880 4420 4040 3875 3505 3280 2990 2770 2510 2270 2055 1855 1675					
67-28 4383 4190 3795 3465 3325 3010 2815 2565 2375 2155 1950 1765 1590 1440					
64-31 3776 3610 3270 2985 2865 2595 2425 2210 2045 1855 1680 1520 1370 1240					
60-35 3130 2990 2710 2475 2375 2150 2010 1830 1695 1535 1390 1260 1135 1025					
56-39 2679 2560 2320 2118 2033 1840 1720 1565 1450 1315 1190 1080 970 880					
53-42 2333 2230 2020 1845 1770 1605 1500 1365 1265 1145 1035 940 850 765					
49-46 2045 1955 1770 1615 1550 1405 1315 1195 1105 1005 910 825 745 670					
46-49 1815 1735 1570 1435 1375 1245 1165 1060 980 890 805 730 660 595					
42-53 1458 1395 1260 1150 1105 1000 935 850 785 715 645 585 530 480					
39-56 1270 1215 1100 1005 965 875 815 740 685 620 560 510 460 415					
35-60 1085 1040 940 860 825 745 695 630 585 530 480 435 395 355					
31-64 885 850 770 705 675 610 570 515 475 430 390 355 320 290					
28-67 765 730 660 605 580 525 490 445 410 370 335 305 275 250					
25-70 650 625 565 515 495 450 420 380 350 315 285 260 235 215					
22-73 550 525 475 435 415 375 350 320 295 265 240 220 200 180					
RATIO OF HIGH TO LOW SPEED 1.6 1.8 2.2 2.6 3 3.6 4.1 5 5.5 6.5 7.9 9.1 11 13					

SPINDLE RUNNING FAST — FORWARD — REVERSE — CROSS — OPEN — DRIVING SHAFT BELT

*THESE COMBINATIONS NOT TO BE USED IN OPPOSITE DIRECTION.

196 TWO-SPEED COMBINATIONS

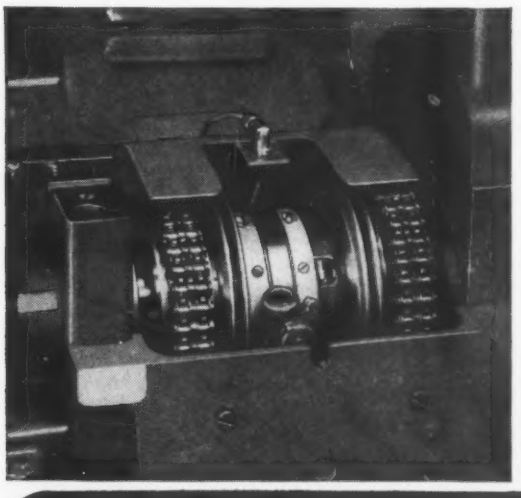
are provided with a range from 6050 to 50 R.P.M. on the "OOG," and a range of 4230 to 35 R.P.M. on the "OG." Approximate ratios of high to low speeds range from 1.6:1 to 13:1 except for highest and lowest high speeds where ratios range from 1.6:1 to 11:1.

HIGH SPEEDS EASILY CHANGED

by one pair of pick-off gears. Gears quickly withdrawn from splined shafts by loosening clamp nuts, releasing washers. Replaced by another set from storage compartment in door. One set of 16 gears provides not only 16 high speeds, but also all ratio changes.

LOW SPEED RATIO AND DIRECTION

equally easy to change. Selecting the direction of low speed is done merely by placing lower of two change gears on proper one of two centers. Driving sprockets and spindle driving chains remain untouched.



CHAIN-DRIVEN FULL-ANTIFRICTION-BEARING SPINDLE

Positive drive of spindle by roller chains at all speeds insures required power throughout full range of operations within capacity of machine. Spindle readily removable. End thrust is taken by preloaded, precision ball bearings.

SHARPE

B·S

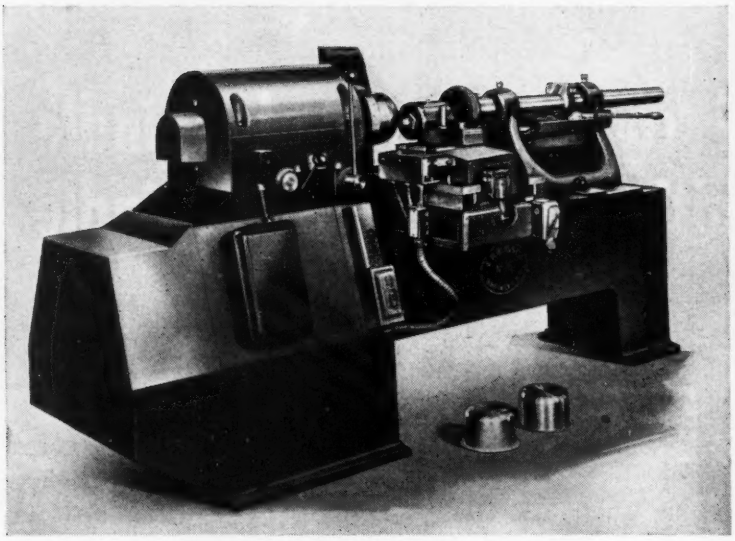


Fig. 1. Bliss Spinning Lathe with Independently Operated Hydraulic Cross-slide Attachment

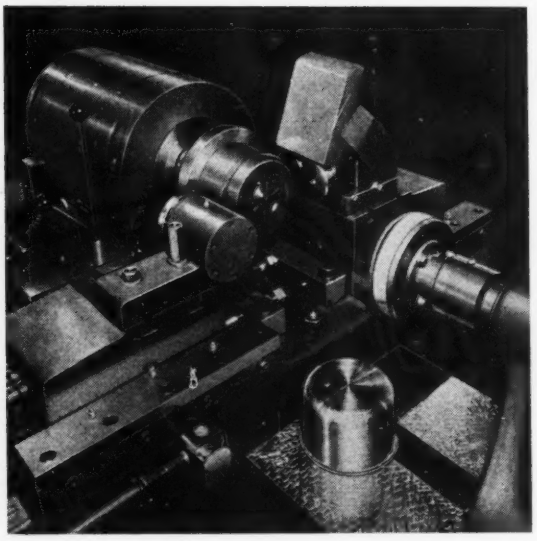


Fig. 2. Close-up View of Hydraulic Cross-slide Attachment

Bliss Second-Operation Spinning Lathe

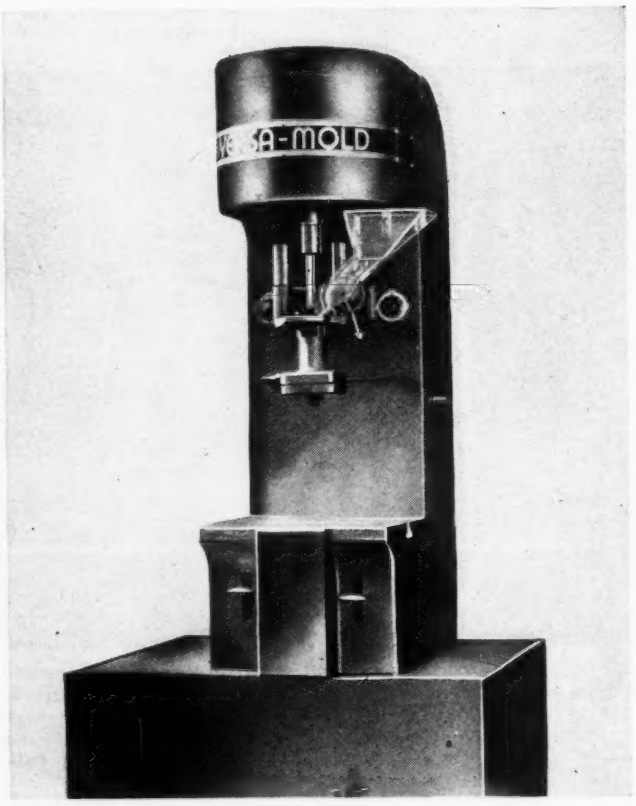
The E. W. Bliss Co., 450 Amsterdam St., Detroit 2, Mich., has designed and built an independently operated hydraulic cross-slide attachment for second-operation spinning lathes which is especially constructed to eliminate operator fatigue and insure effective operation in trimming, beading, curling, or wire rolling work.

The entire operation of the slide is arranged for automatic cycle control, with push-button starting. It is timed to enable trimming cutters at the rear of the attachment to move inward and trim the edge of the part. These cutters, upon completing their work, recede automatically, allowing the beading or curling attachments to perform their part of the work. At the end of these operations, the curling and beading attachments return to their original positions, giving free access to the operator for removal and replacement of work. The cross-slide attachment can be removed when desired.

This spinning lathe is available in bed lengths of 69 and 92 inches. The chuck and tail plates are 18 by 24 inches. Speed ranges from 275 to 1140 and from 180 to 1140 R.P.M. are available. 89

Versa Molding Press

A new one-ounce capacity injection molding press for molding nylon, Lucite, Plexiglas, polystyrene, and other thermoplastics is being placed on the market by the Ferracute Machine Co., Bridgeton, N. J., under a license arrangement with the Radio Corporation of America. Basically, this is an air-actuated ram type press capable of exerting a ram pressure of 8000 pounds at an air-line operating pressure of 80 pounds per square inch.



Versa Molding Press for Plastic Materials

The double-acting air cylinder and press mechanism are enclosed in a streamline frame. Directly below the ram is an electrically heated material-holding cylinder which is vertically mounted on an arm and supported by coil springs in such a way as to permit a limited up and down movement. The bottom of the cylinder has a suitable outlet nozzle.

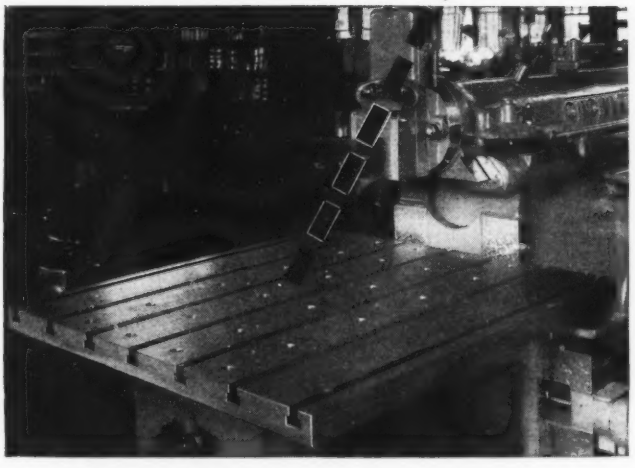
With the injection ram in the retracted position and the cylinder loaded with material, the closed mold is placed on the base of the press, the cavity being located directly beneath the nozzle in the cylinder. The height of the top of the mold is adjusted by spacer plates to bring it within range of the up and down movement permitted by the coil springs.

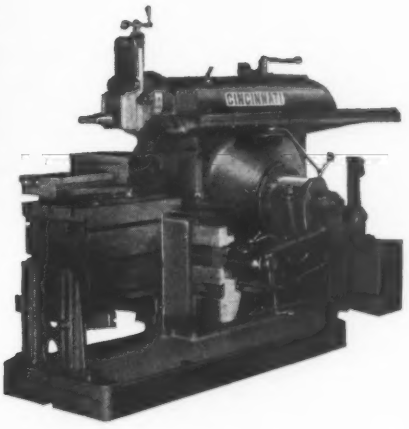
When the material in

To obtain additional information on equipment described on this page, see lower part of page 220.

EXTRA CLAMPING SURFACE HERE...

Photo courtesy of
Marion Machine Foundry & Supply Company





Some castings are bulky and awkward to handle. Often they present a setup problem, as it may be difficult to clamp them firmly to the regular shaper table.

The large area of the Cincinnati Supplementary Table Top saves setup time, and the full clamping improves the accuracy. It is applied easily and widens the use of Cincinnati Shapers. It is just one of the many useful accessories available.

Cincinnati Shapers are powerful and have a lasting built-in accuracy. They are profitable in the shop.

Write for Catalog N-3.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

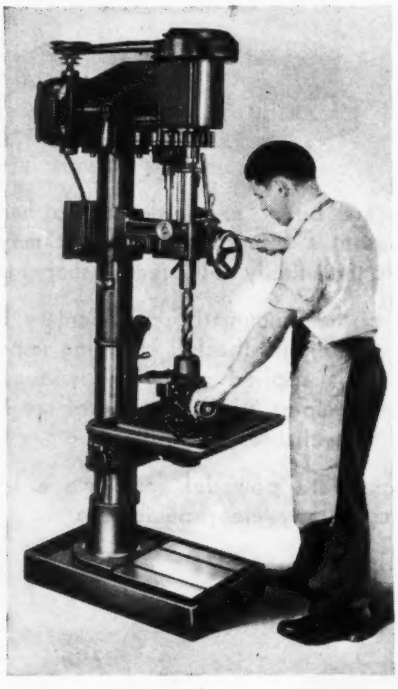
SHAPERS · SHEARS · BRAKES

the cylinder has reached the correct molding temperature, the air piston of the press is actuated, forcing the ram down and causing the plastic material to be injected into the mold. At the return of the ram, the cylinder is raised by spring action. 90

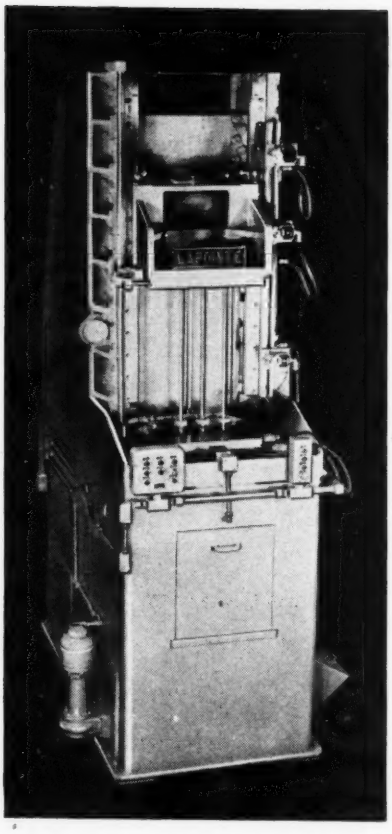
Sibley High-Speed Drilling Machine

An entirely new high-speed precision drilling and tapping machine has been announced by the Sibley Machine & Foundry Corporation, South Bend 23, Ind. This machine has a 20-inch swing, is sturdily constructed, and is equipped with a 2-H.P. motor which furnishes ample power for drilling 1 1/2-inch holes in mild steel. Although designed especially for sensitive drilling and tapping operations at high speed, it is also recommended for use as an all-purpose machine.

Geared power feeds of 0.003, 0.006, and 0.010 inch per revolution can be selected by simply turning a knob. Spindle speeds are changed quickly by a positive release lever, speeds of 65, 95, 150, and 225 R.P.M. being obtained by the use of back-gears, and speeds of 400, 575, 900, and 1360 R.P.M. being available by direct drive. A rectangular oil-grooved table is furnished with this machine.....91



Sibley High-speed Drilling and Tapping Machine



Lapointe Vertical Hydraulic Broaching Machine with Positive Broach Guide

Lapointe Broaching Machines

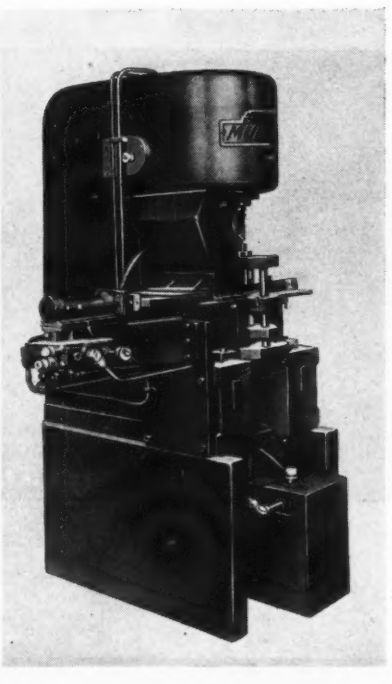
Six new machines tooled to produce various contours, grooves, slots, and holes in a wide variety of parts, including lock cylinder barrels, safety razor caps, wrench handles, rifle barrels, jet-engine compressor wheels, and automobile clutch hubs, were demonstrated by the Lapointe Machine Tool Co., Hudson, Mass., at the recent Machine Tool Show in Chicago. The machines exhibited included vertical and double-arm types, with capacities ranging from 2 1/2 to 20 tons and strokes from 18 to 66 inches.

Although similar in construction to the standard V-3 type, the special 20-ton, 42-inch stroke machine here illustrated is heavier throughout and incorporates a positive broach guide for maintaining accurate vertical alignment. It is provided with a standard in-and-out fixture and is equipped for broaching three different sizes of automobile clutch hubs at a time. This machine, with its rotor-cut broach, can cut multiple holes with center distances accurate to 0.0005 inch. ..92

Automatic Pelleting Multipress for Processing Powdered Materials

Powdered or granular forms of metals, ceramic chemicals, or plastics, including many materials formerly considered unsuitable for handling on automatic machines, can be processed on a new automatic pelleting "Multipress" recently added to the line of the Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio. Outstanding features of this Multipress include independent control of charging, compacting, and ejecting ram actions; easily tooled for rapid die changes; easy cleaning and quick die fill adjustments; use of single- or multiple-cavity dies for either solid or cored parts; and fully automatic and completely interlocked ram actions.

The Denison vibratory control is incorporated in both the die charging and the compact rams of this press. Repeat strokes of the ram during compaction is said to result in better expulsion of air from the die and consequently improved control of part density, more uniform distribution of material in the die, and improved finish on the edges of formed parts. Vibratory action of the charging box assures a more even filling of the die. 93

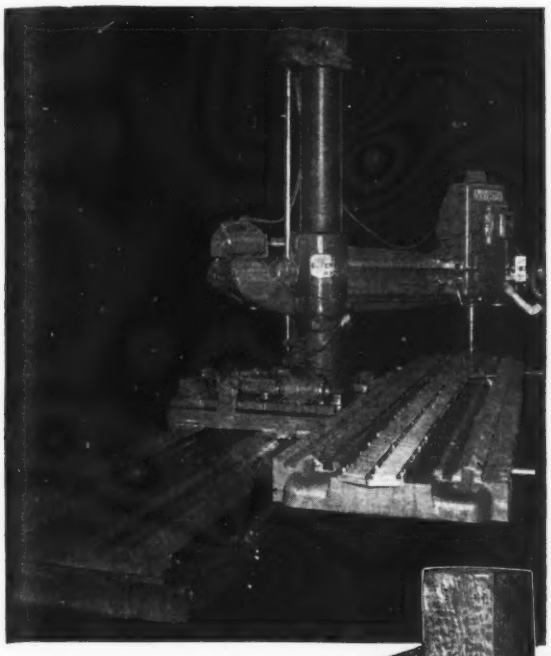


Denison Automatic Pelleting Press for Powdered Materials

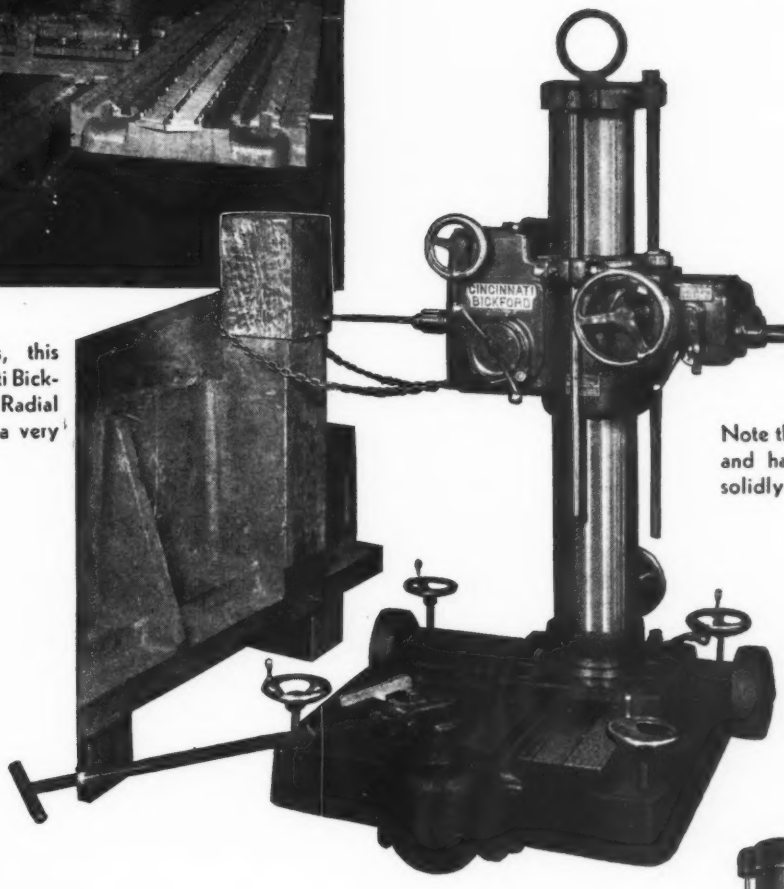
To obtain additional information on equipment described on this page, see lower part of page 220.

Profitable Applications

of Traveling BICKFORD Radial Drills

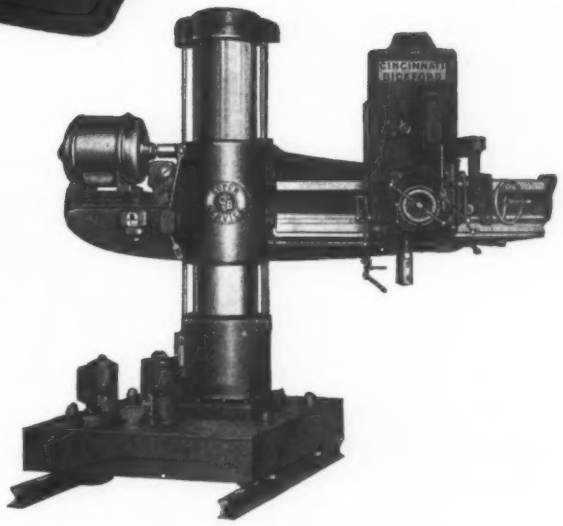


Mounted on ways, this sliding base Cincinnati Bickford Super Service Radial Drill is working on a very long casting.



Note the three-wheel base is easily moved and handled—in operation the base rests solidly on 4 leveling screws.

Moved by power, this track mounted Cincinnati Bickford Super Service Radial Drill has an unusually heavy base, rolling on hardened steel wheels.



When it is an advantage to move the drill to the work, Cincinnati Bickford Super Service Radial Drills, in various sizes and styles, are equipped for this service.

The "Portable Horizontal" is an inexpensive, 100% mobile machine, and offers great advantages on work within its range.

Powered with a 1½ horsepower motor, the base is equipped with leveling screws and built-in levels. Very handy; is easily rolled along the floor or moved by crane.

Large, cumbersome castings are being profitably handled by Cincinnati Bickford Super Service Radial Drills.

Write for Bulletin H-R, on the Horizontal Radial, or let us consult with you on your drilling problems on large castings.

See our Condensed Catalog in Sweet's File.

Equal Efficiency of Every Unit Makes the Balanced Machine.

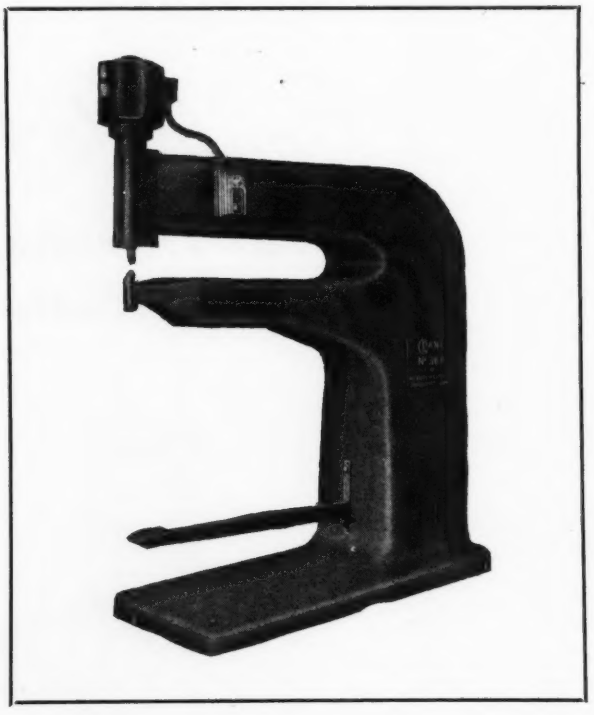
RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Grant Noiseless Rivet-Spinning Machine

The Grant Mfg. & Machine Co., 90 Silliman Ave., Bridgeport 5, Conn., has added another noiseless rivet-spinning machine to its line. This new model—the No. 367 spinner—is designed to handle riveting jobs requiring a throat depth much greater than that available on previous models.

The new spinner has a throat depth of 36 inches. It will form heads on rivets from the smallest size up to and including 1/4 inch in diameter. A 1-H.P. motor is furnished with the machine. The machine weighs 2000 pounds, and requires 25 by 60 inches floor space. 94



Grant Noiseless Rivet-spinning Machine

"Bordjaw" Precision Chuck for Small Lathes

A precision chuck known as the "Bordjaw," which is similar in many ways to a collet chuck, has just been placed on the market by the Edward Blake Co., 634 Commonwealth Ave., Newton Centre 59, Mass. The chuck is produced by the University Machine Co., Division of Baird Associates, Inc., Cambridge, Mass.

This chuck is so designed that the jaws do not draw back when closed, their only movement being a lateral one. It can be faced and bored after it is mounted in the lathe. The jaws can also be bored while the chuck is mounted in a lathe, thus insuring concentricity. Different sets of jaws can be kept on hand for repeat jobs.

The jaws can be bored for holding thin pieces so as to insure concentricity and permit accurate facing. Thus, thin pieces can be machined with assurance that the faces will be parallel.

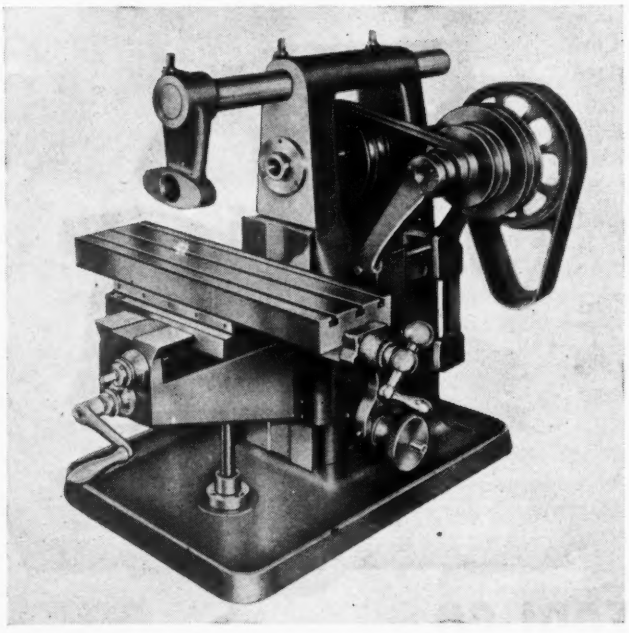
The body of the chuck is marked so that the jaws can be removed and replaced without affecting the accuracy. The chuck itself can also be removed from the lathe and replaced without affecting the accuracy of the work.

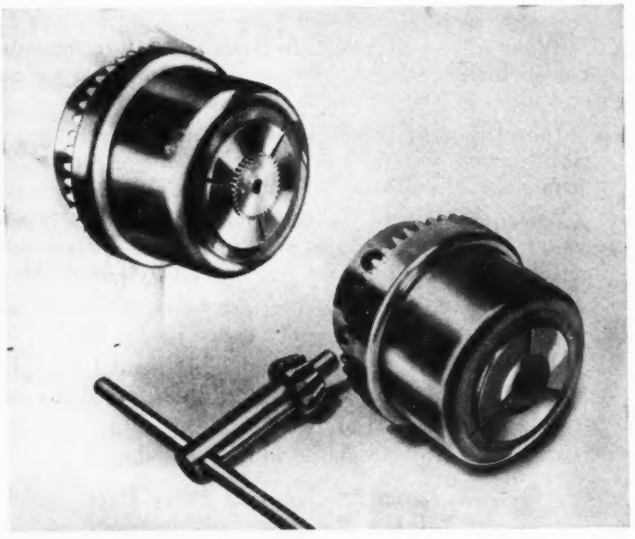
Diamond Bench Milling Machine

The Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif., has recently added to its line of milling machines a larger bench type model weighing 450 pounds. The 4 1/8- by 20-inch table of this machine has a longitudinal travel of 12 inches, a vertical travel of 9 inches, and a transverse travel of 6 inches.

The spindle is mounted in tapered roller bearings, and is equipped with a No. 9 B&S taper. The arbor is supported in a needle type bearing.

Power is transmitted to the spindle through a three-step pulley with V-belts designed for taking heavy cuts without belt slippage. The bracket that supports the jack-shaft is arranged to facilitate rapid belt shifting and tension adjustment. The spindle speeds range from 100 to 1400 R.P.M. 95





(Above) "Bordjaw" Precision Chuck for Small Lathes

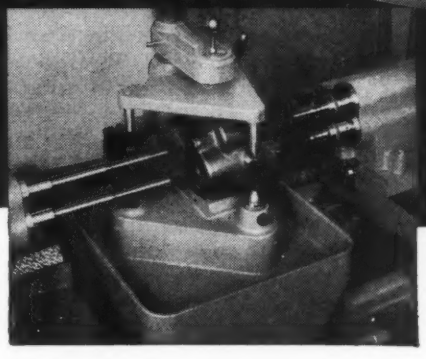
(Left) Diamond Bench Type Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 220.

Ex-Cell-O Way-Type Precision Boring Machines Offer Specialized Multiple Operation at Low Cost

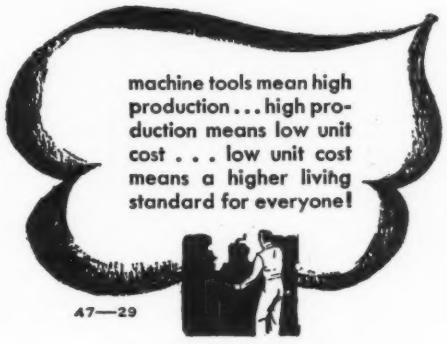
XLO

Illustrated here is an Ex-Cell-O Two Way Precision Boring Machine designed for boring holes in cast iron automotive transmission cases. To meet production requirements it was necessary to bore the holes at both ends at the same time.



Above: Special cluster spindles are required here because of close center distances of bored holes. Because boring bars at left are long and slender the ends are further lengthened to engage pilot bushings in the fixture.

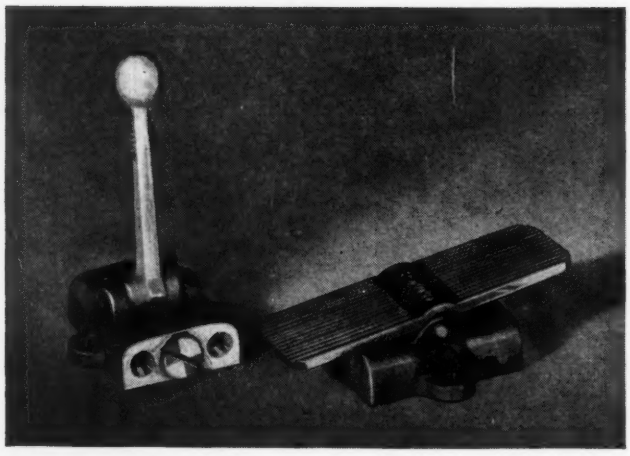
Ex-Cell-O Way machines are made to order for work like that illustrated here. They are built up from standard way units that can be operated simultaneously or in sequence as the work requires. Way machines do the work of special machines, but the use of standard units keeps the first cost low and, as production requirements change, the units may be rearranged to accommodate different work. Ex-Cell-O One Way Precision Boring Machines are especially suitable for heavy or awkward work. Two Way Machines accommodate awkward and long work pieces and save time by boring from both sides simultaneously. Three and Four Way Machines are particularly suitable for boring holes perpendicular to one another. An important feature of Way Machines is that multiple operations are performed from the same work locating points, with only one handling of the parts.

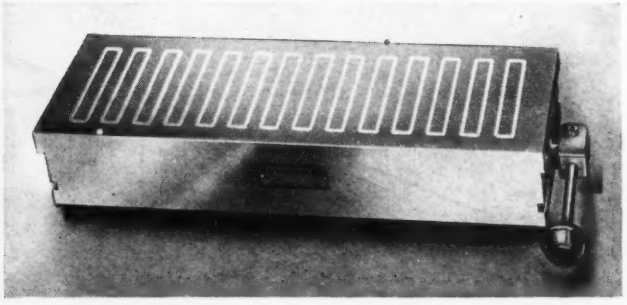

machine tools mean high production . . . high production means low unit cost . . . low unit cost means a higher living standard for everyone!
47—29

EX-CELL-O CORPORATION

DETROIT 6 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS • FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES





(Above) Permanent Magnet Chuck Made by O. S. Walker Co., Inc.

(Left) Ross Lever and Foot-operated Air Control Valves

The new chuck is made for lathes having threaded nose spindles with a 1/2-inch 8-pitch thread. The closing ring is operated by a key which permits an exceedingly firm grip to be obtained when desired.....96

Ross Air Control Valves

The Ross Operating Valve Co., Department K, 6455 Epworth Blvd., Detroit 10, Mich., had on exhibition at the Machine Tool Show a new small-size poppet type air control valve designed expressly for use on light machine tools, vises, fixtures, presses, and other machinery adaptable to air control. The valve can be supplied for either hand-lever or foot-treadle operation. The vertical lever action is particularly suitable for small machine tool installations.

Both the foot-treadle and hand-lever valves are available in three- and four-way styles. All are made in locking, non-locking, or neutral-position types. 97

Walker "Permanent" Chuck

The O. S. Walker Co., Inc., Worcester 6, Mass., has developed a new permanent magnet chuck of materially reduced weight and height. This chuck in the 6- by 18-inch size now weighs only 90 pounds, or 45 pounds less than the original design, and its height has been reduced to 3 3/16 inches, allowing more head-room than was available with previous models. Both of these features are supplemented by an increase of 5 per cent in the holding force of the chuck. Similar improvements have been made in the 4- by 8- and the 5- by 10-inch sizes.....98

Internal Finishing Machine and Circular Graduating Machine

The Abrasive Machine Tool Co., East Providence 14, R. I., has recently announced an internal finishing machine, shown in Fig. 1, designed primarily for finishing the bores in small round dies or similar work. The finish obtained by the use of this machine is said to be of such quality that no further lapping or finishing operations are required for most classes of work.

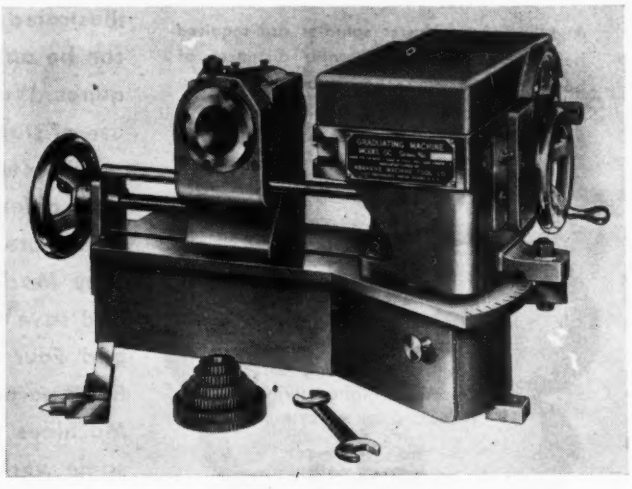


Fig. 1. (Left) Internal Finishing Machine Brought out by the Abrasive Machine Tool Co.

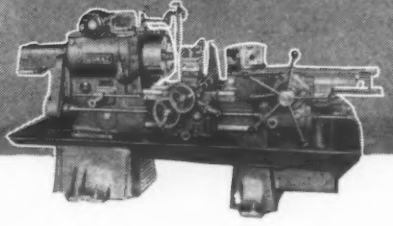
Fig. 2. (Above) Abrasive Machine Tool Co.'s Power-operated Circular Graduating Machine

To obtain additional information on equipment described on this page, see lower part of page 220.

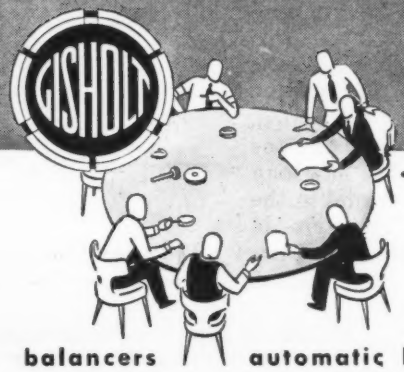
GISHOLT TURRET LATHES

Hydraulic speed selector cuts operator's time as much as 30% —and insures better work

It's power-operated. No manual gear shifting, no needless effort, no waste time between cuts. It increases efficiency on all kinds of turret lathe jobs.



GISHOLT MACHINE COMPANY, *Madison 3, Wisconsin*



...the Gisholt round table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

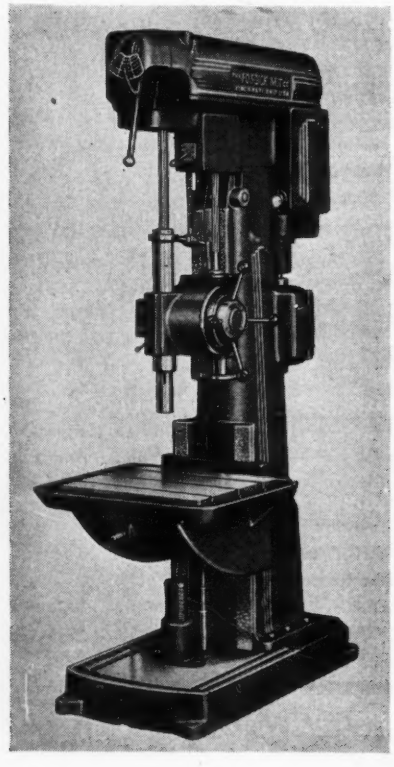
turret lathes · balancers · automatic lathes · superfinishers · special machines

Fast removal of stock is accomplished by a patented reciprocating action applied to the grinding-wheel head which causes the diamond wheel to be moved constantly backward and forward a few thousandths of an inch while the surface of the hole is being ground. This action results in fast removal of stock and the production of a mirror finish on the final cuts.

The small power-operated circular graduating machine shown in Fig. 2 is another product of the Abrasive Machine Tool Co., originally developed for use in this company's own factory for calibrating handwheels, dials, and similar parts. Simplicity and speed of operation are outstanding features of this machine.....99

Fosdick Upright Drilling Machine

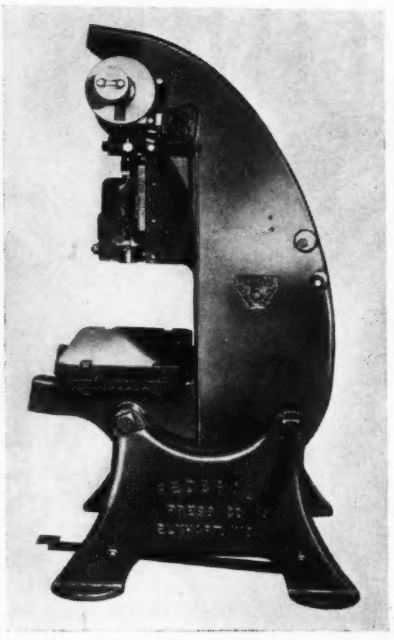
A 21-inch upright drilling machine having a capacity between that of a sensitive drilling machine and a heavy-duty upright drilling machine has been added to the line of the Fosdick Machine Tool Co., Cincinnati 23, Ohio. The gear-box of this new machine provides nine or eighteen speeds and four feeds. Any speeds from 110 to 900 or 220 to 3600 R.P.M. can be obtained with feeds of from 0.002 to 0.010 or 0.004 to 0.020 inch.



Upright Drilling Machine Built by the Fosdick Machine Tool Co.

The gear-box is cast integral with the top bracket, and a pump is placed directly under it to supply oil to the bearings and heat-treated gears. The drive to the spindles is through multiple V-belts. A single- or two-speed motor is mounted underneath the top bracket.

The power feed is operated from a positive clutch which actuates serrated blocks that engage a serrated ring. The feed clutch engages when the drill comes in contact with the work. An "overtake" feature permits the drill to be advanced without disengaging the feed dial. A knob on the head can be set for either tapping or drilling operations. 100



Federal Press Equipped with New Non-repeat Clutch

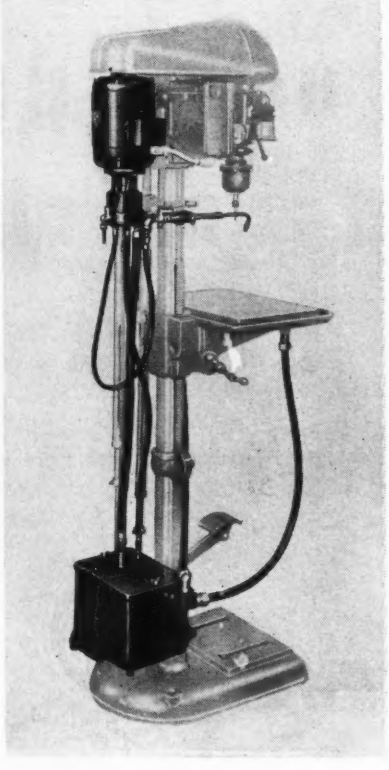
Non-Repeat Clutch for Federal Presses

The Federal Press Co., Elkhart, Ind., has developed a new non-repeat clutch mechanism for its line of open-back inclinable presses. This new feature is designed to insure single-stroke operation, regardless of how quickly the foot-pedal is depressed or how long the operator holds the pedal in the depressed position. The trip is easily operated, and has been especially designed to reduce operator fatigue to a minimum and provide positive stroke control.

With this new clutch mechanism, the operator need not move from the working position or employ any tools to adjust or change the machine from single-stroke to automatic-cycle operation. This is accomplished by simply giving the positive-control bolt a quarter-turn. When adjusted for single-cycle operation, the non-repeat clutch provides for one complete cycle and stop before the press can be retripped. Down-stroke "repeats" and accidents caused by the crank passing its cycle center are prevented. This new safety feature is now available on all Federal presses from 6 to 80 tons.....101

Procunier Tapping Machines

A new series of universal tapping machines equipped with a continuous-flow "Hi-Boy" pump has been brought out by the Procunier Safety Chuck Co., 18 S. Clinton St., Chicago 6, Ill. The lubricating pump provided with this machine is of the motor-driven gear type. Lubricant is supplied to the tap while it is backing out, as well as during the tapping operation. Fixtures are



Procunier Tapping Machine with Continuous-flow Lubricating Pump

To obtain additional information on equipment described on this page, see lower part of page 220.

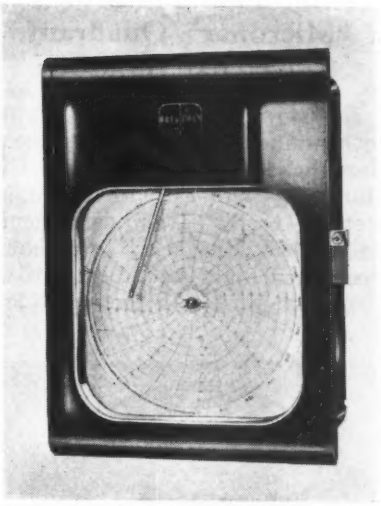
also washed clean of chips and shavings by the continuous flow of coolant.

The driving and reversing pressures on this new tapping machine are pre-set by long compensating springs, which maintain proper pressure on the tap regardless of the pressure applied to the foot-pedal, thus enabling high speed, uniformly accurate tapping with a minimum of tap breakage or spoiled work.

This universal tapping machine is made in two sizes. The small size has a capacity for tapping No. 2 up to 5/16-inch threads in steel, 3/8-inch in cast iron and 1/2-inch in brass. The large size machine will drive from a No. 10 tap up to a 1/2-inch tap in steel, a 5/8-inch tap in cast iron, and a 3/4-inch tap in brass.....102

Hannifin Improved Hydraulic Power Unit

Improved types of standardized hydraulic power units for use in conjunction with hydraulic cylinders and other hydraulically operated equipment are announced by the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill. These new units, distinguished outwardly by streamline appearance and compact arrangement, provide for any required pump capacities from 1 gallon per minute up and for pressures up to 2000 pounds per square inch or more.



Bristol Recording Gage

Regular equipment includes pump, pressure relief and adjusting valve, flexible pump-motor coupling, and hydraulic pressure gage. Standard motors are used with this unit. 103

Bristol Recording Thermometers and Gages

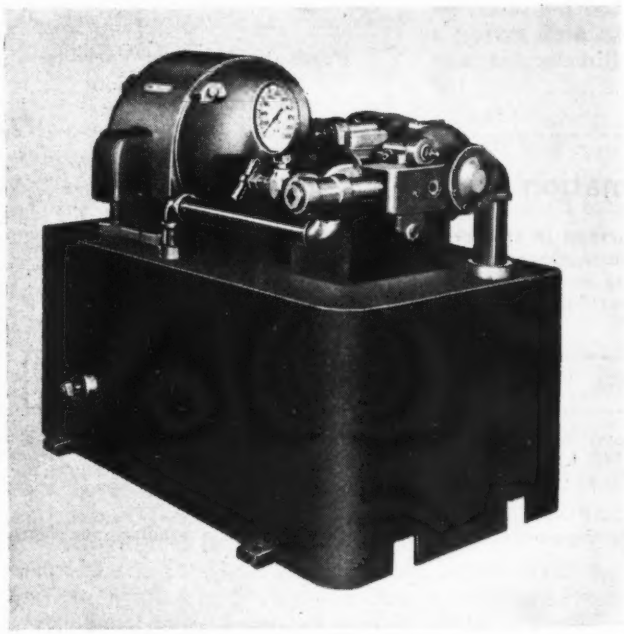
A line of recording thermometers and gages with improvements designed to make them easier to use, more convenient to service, and readily convertible from one type of mounting to another has been placed on the market by the Bristol Co., Waterbury 91, Conn. The cases of these gages are so designed that they can be mounted either on a wall, the front of a panel, or flush with the front of a panel. They can also be easily converted by the user at any time from one type of mounting to another. Other features include a heavy inlaid sponge-rubber door gasket, flush roll type door handle, and non-projecting door hinges.

The recording pen arms are pivoted on stainless-steel journals, with the shaft supported at both ends in a rigid one-piece mounting. The journal bearings are ground and polished. These thermometers and gages are made in 8- and 12-inch sizes. 104

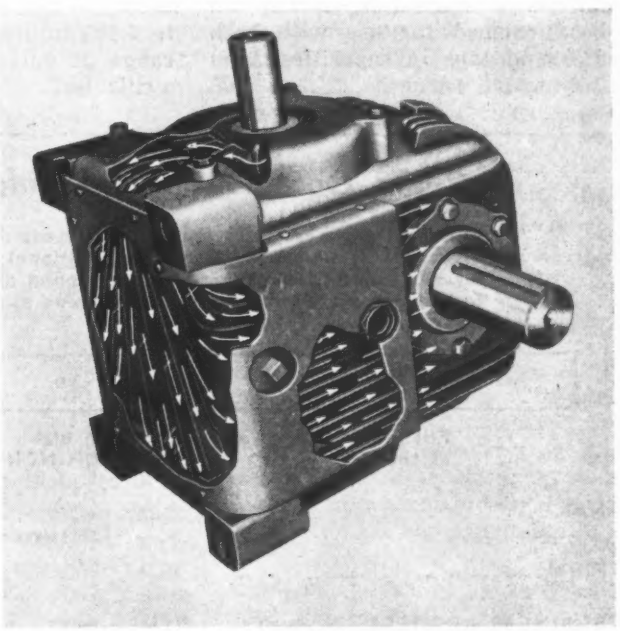
Cone-Drive Speed Reducers

The Cone-Drive Division of the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich., has announced a new line of fan-cooled Cone-Drive speed reducers which eliminate the necessity for taking thermal ratings into consideration when selecting speed reducers. The maximum mechanical horsepower ratings of the speed reducers only need be considered.

The use of Cone-Drives permits greater smoothness, since a larger number of teeth in the gears are in continuous contact. The larger contact area per tooth further increases the capacity of the gears to transmit the higher power required by carbide tooling.....105

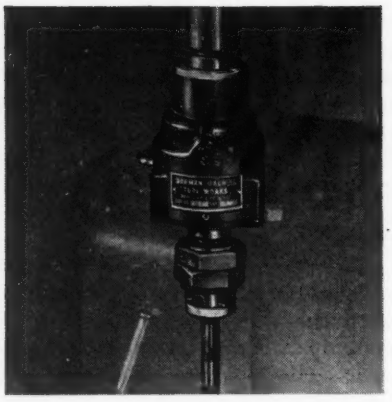


Hannifin Hydraulic Power Unit of Improved Design



Cone-Drive Speed Reducer Built by Michigan Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 220.



Dorman Tapper Equipped with Acorn Die-holding Assembly

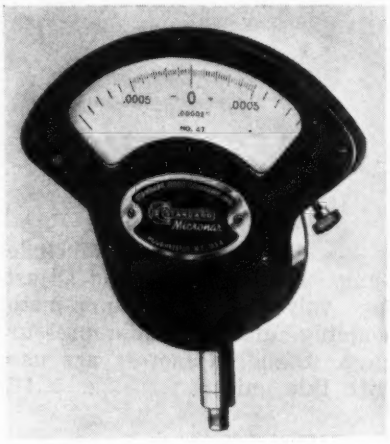
Dorman Tapping and Threading Tool

Die-holder assemblies have now been developed by the Dorman Machine Tool Works, 38 S. MacQuesten Parkway, Mount Vernon, N. Y., which permit the use of all sizes of Dorman tappers for external threading in addition to their standard accepted use for tapping. The illustration shows a No. 1 size tapper equipped with an acorn die-holding assembly attached to a drill press. This equipment is being used for threading cold-rolled steel bars with a 3/8–16 acorn die to a length of 1 1/4 inches. A 3-jaw scroll chuck is used to hold the bars. The production rate is 180 pieces an hour.

These tappers can be furnished with die-holders for external threading only, using round split, button, or acorn dies, or they can be furnished for use with both dies and taps in capacities from 2–56 to 1 1/4 inches. 106

"Micronar" Quadrant Type Dial Indicator

A quadrant type dial indicator with standard mounting dimensions has been announced by the Standard Gage Co., Inc., Poughkeepsie, N. Y. This instrument, designated "Micronar," is a wholly mechanical dial type indicator with a high amplification factor, which



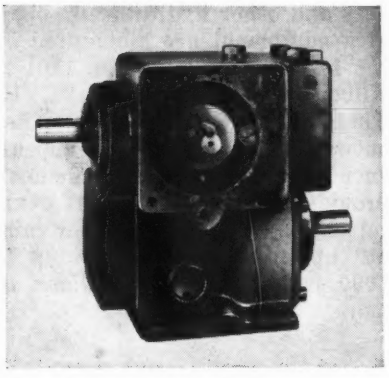
"Micronar" Dial Indicator Made by Standard Gage Co., Inc.

is said to be suitable for use on comparators and on fixtures employed for work that must be held to close tolerances. The scale of the English unit model is divided into 0.0001-inch steps, and in the center portion these intervals have been sub-divided to 0.00002 inch. The effective range is 0.0018 inch. A sapphire-tipped contact point is used. A metric model, graduated to 0.001 millimeter, and having a range of 0.04 millimeter, is also available. 107

Small Hydraulic Variable-Speed Transmission

A new small-size hydraulic variable-speed transmission has been announced by the Portman Machine Tool Co., 70 Portman Road, New Rochelle, N. Y. This transmission provides infinitely variable speeds from zero or neutral to full electric drive motor speed in either a forward or a reverse direction. The wide range of speeds in either direction, combined with a full neutral position, makes this transmission adapted for a variety of machine drive applications. It is of the multiple-piston constant-torque type, with a maximum rating of 1 horsepower and a maximum output torque of 52 1/2 pound-inches.

This transmission can be furnished with various types of speed controls, including manual control by means of a handwheel or lever, as well as remote controls. 108



Portman Hydraulic Variable-speed Transmission

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in October, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 224 the Identifying Number at End of Descriptive Paragraph or Write Directly to Manufacturer, Mentioning Catalogue Described in the October, 1947, Number of MACHINERY

Manual of Aluminum Casting Alloys

ALUMINUM RESEARCH INSTITUTE, 111 W. Washington St., Chicago 2, Ill. "Manual of Aluminum Casting Alloys," containing 78 pages of data for design engineers, foundrymen, and users of castings, covering physical and mechanical properties of the most commonly used aluminum alloys; general metallurgy of aluminum alloys; the properties of specific alloys; foundry practice; and heat-treatment. Available without charge to those making a request on a company letter-head addressed directly to the Institute.

Hydraulic Accumulators

GREER HYDRAULICS, INC., 454 Eighteenth St., Brooklyn 15, N. Y. Booklet on hydraulic accumulators for fluid power, describing the various types and outlining the main features of the Greer unit. Engineering data, including construction details, principles of operation, and performance charts is given. Copies can be obtained by those interested if requested on a company letter-head, addressed to Greer Hydraulics, Inc., giving the position of the writer.

Aluminum Design Data

HARVEY MACHINE CO., INC., 19200 S. Western Ave., Torrance, Calif. Design manual containing data covering standard aluminum extrusions, such as tolerances, conditions of heat-treatment, composition and properties, etc. Copies are available if requested on a company letter-head, addressed directly to the Harvey Machine Co.

Interchangeable Punches and Retainers

WHITMAN & BARNES, 2100-2200 W. Fort St., Detroit 16, Mich. Catalogue 99, containing complete data on Hercules retainers and interchangeable punches. Copies can be obtained by interested persons if requested on a company letter-head addressed directly to Whitman & Barnes.

Buffing and Polishing Machines

STANDARD ELECTRICAL TOOL CO., 2500 River Road, Cincinnati 4, Ohio. Catalogue B-10, illustrating the company's line of heavy-duty and extra heavy-duty buffing and polishing machines, as well as the line of infinitely variable speed buffing and polishing machines with "Speedial" control. 1

Anti-Friction Bearings

S K F INDUSTRIES, INC., Philadelphia 32, Pa. 60-page catalogue of machine tool anti-friction bearings and spindle designs suited for carbide tools; includes an engineering section giving the relation between cutting tool loads and bearing life, as well as data on bearing selection, load distribution, speed limitations, mounting, and applications. 2

Thread-Grinding Handbook

NORTON CO., Worcester, Mass. Booklet containing data for operators of thread-grinding machines, including information on grinding with single and multi-ribbed wheels and centerless grinding. Work and wheel speed, thread form, selection of the proper wheel for various classes of work, and other valuable information are given. 3

Special Machines, Tools, and Fixtures

ZAGAR TOOL, INC., 23880 Lakeland Blvd., Cleveland 17, Ohio. Catalogue M-9, illustrating and describing the company's complete line of tools and special machinery, including collets and fixtures; gearless multiple-spindle drilling and tapping heads; broaches and broaching machines; and jig borers. 4

Gages and Tools

GAUGE & TOOL MAKERS' ASSOCIATION OF GREAT BRITAIN, Standbrook House, Old Barn St., London, W. 1, England. Export catalogue for 1947, covering the products of the members of this Association, which include gages, jigs and fixtures, tools, dies, and molds. Copies are available in English, French, Spanish, and Portuguese. 5

Pickling and Neutralizing Materials

OAKITE PRODUCTS, INC., 126 Thames St., New York 6, N. Y. Service report, describing improved pickling and neutralizing procedures for use on iron and steel. Containing data on some specialized materials recently developed by the company. 6

Electric Trucks

ELECTRIC INDUSTRIAL TRUCK ASSOCIATION, 29-28 Forty-first Ave., Queens Plaza, Long Island

City 1, N. Y. Booklet entitled "Looking Beyond the Price Tag," discussing the importance of dependability, handling speed, low operating cost, safety for workers, and freedom from noise, fumes, and odors in electric industrial trucks. 7

Mounted Wheels for Portable Grinders

CARBORUNDUM CO., Niagara Falls, N. Y. Booklet containing thirty-two pages of data on the company's line of mounted wheels for use on light portable grinding equipment. Examples of the many wheel shapes and sizes available and typical applications on production operations are shown. 8

Oil-Retaining Bronze Bearings

BOUND BROOK OIL-LESS BEARING CO., Bound Brook, N. J. Stock List No. 3, covering Compo oil-retaining porous bronze bearings carried in stock for immediate delivery. Data on material, specifications, standard tolerances, installation procedure, and permissible loads is included. 9

Herringbone-Gear Reducers

LINK-BELT CO., 2045 W. Hunting Park Ave., Philadelphia 40, Pa. Catalogue 1819, containing 68 pages covering the complete line of Link-Belt enclosed herringbone-gear units designed for heavy-duty industrial service. Horsepower ratings, lubrication data, and other engineering information is given. 10

Automatic Machines

SUNDSTRAND MACHINE TOOL CO., 2531 11th St., Rockford, Ill. Circular 22-1, describing the outstanding features of the new Sundstrand Model 22 duplex Rigidmil. Circular illustrating and describing in detail a new design of automatic lathe for both long and short runs on small parts. Complete specifications are given for both machines. 11

Precision Chucks

EDWARD BLAKE CO., 634 Commonwealth Ave., Newton Centre 59, Mass. Bulletin descriptive of the University "Bordjaw Chuck," a small precision lathe chuck especially designed to obtain maximum efficiency when using the bored-jaw method of holding work. 12

Automatic Chucking Machines

NEW BRITAIN-GRIDLEY MACHINE DIVISION, NEW BRITAIN MACHINE CO., New Britain, Conn. Catalogue 720-1P, describing the construction details of three new models of four-spindle automatic chucking machines made by the company. 13

Thickness Gages

SPERRY PRODUCTS, INC., 1505 Willow Ave., Hoboken, N. J. Technical Data Sheet 3700, describing the operation and application of the Sperry "Reflectogage" for measuring thicknesses of parts, only one side of which is accessible. 14

Burring Tools

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Catalogue describing the company's complete line of high-speed steel burrs, carbide burrs, and file-cut burrs. Typical applications are shown and specifications are included...15

Electric Control Equipment

WESTINGHOUSE ELECTRIC CORPORATION, P.O. Box 868, Pittsburgh 30, Pa. Booklet B-3649, describing the construction and application of the "Rototrol," a control mechanism for regulating voltage, speed, current, power, and other conditions. 16

Cast Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y. Booklet covering the engineering properties and applications of "Ni-Resist," a cast nickel alloy. Corrosion data for 400 corrosive media are presented in tabular form. 17

Air and Hydraulic Valves

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago 22, Ill. Bulletin 235, giving specifications and operating data on Hanna foot- and hand-operated valves for air and hydraulic lines and speed control valves for use with air and hydraulic cylinders. 18

Air-Operated Controllers

BROWN INSTRUMENT CO., DIVISION MINNEAPOLIS - HONEYWELL REGULATOR CO., Philadelphia 44,

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To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (October, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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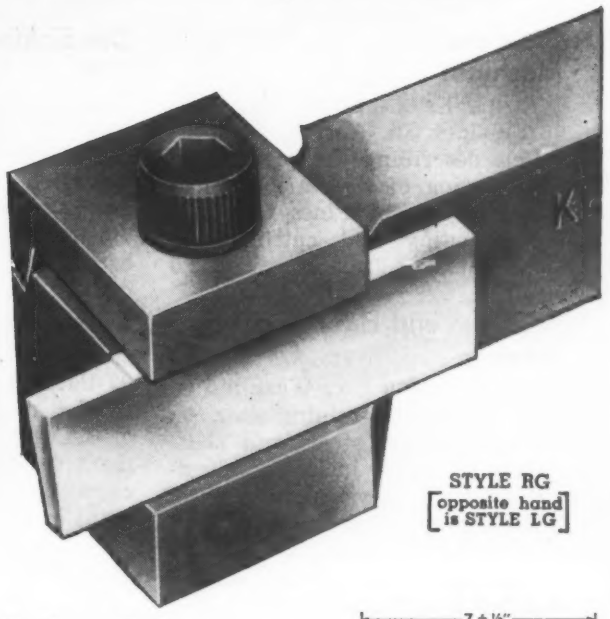
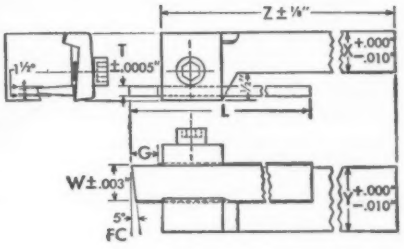
Another KENNAMETAL *First!*

This New GROOVING and CUT-OFF TOOL



STYLE RG
[opposite hand is STYLE LG]



Combines the outstanding rigidity and durability of solid Kennametal blades with the highly successful clamped-in method of mounting.

Kennametal solid grooving blades have been outstandingly successful on multiple blade jobs, such as piston-grooving of light alloys, bronze, and cast iron. Their great rigidity prevents "weaving." They stay sharp much longer, and permit many more regrinds than conventional tools having brazed-in tips.

Now, we have developed a new line of tools that extend the advantages of using solid Kennametal blades to single grooving operations, such as on turret lathes. These tools comprise an advanceable Kennametal blade securely clamped in position in a heat-treated steel holder. The clamping arrangement is such that the blade can be advanced time and again, after each resharpening, until about half its length has been utilized.

Standard Styles RG and LG tools are available having blades of the following thicknesses: .125", .1875", and .250". As supplied, these blades have zero side rake and zero cutting edge angle, and are suitable for normal grooving operations. For cutting off jobs, the cutting edge angle is ground to the usual 5°. Non-standard blades of any thickness from .125" to .250" can be supplied, for use in the standard holders.

Catalog 47 gives complete specifications and prices. Write for a copy.

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
TRADE MARK REG U S PAT OFF
KENNAMETAL Inc., LATROBE, PA.

Outstanding Features

- Rigid Kennametal blade stays sharp much longer.
- Blade can be advanced and reground many times.
- Replacement blades are interchangeable—may be used in either Style RG or LG tools.
- Tool holders accommodate range of blade thicknesses as follows:

  ¾" x 1" x 6" holder accommodates blades from .080" to .149" thickness.

  ¾" x 1¼" x 8", and ¾" x 1½" x 9" holders accommodate blades from .150" to .250" thickness.

Pa. Catalogue 8905, containing 40 pages of data on the company's line of air-operated controllers for temperature, pressure, flow, liquid level, and humidity. 19

Pipe and Tube Bending Machines

PINES ENGINEERING CO., INC., 601 Walnut St., Aurora, Ill. Catalogue describing the features of construction of the various models and types of Pines tube and pipe bending and cutting machines. 20

Stainless and Heat-Resisting Steels

JESSOP STEEL CO., Washington, Pa. Booklet containing data on Jessop stainless steels and heat-resisting steels, including chemical analyses, physical properties, corrosion-resisting ratings, and fabricating properties. 21

Adjustable-Speed Drives

LOUIS ALLIS CO., Milwaukee 7, Wis. Bulletin 611C, describing the Allis "Ajusto-Spede" alternating-current motor with infinitely adjustable speed, designed for application on variable-speed machines requiring a constant torque input. 22

Bench Milling Machine and Accessories

DIAMOND MACHINE TOOL CO., 3429 E. Olympic Blvd., Los Angeles 23, Calif. Catalogue descriptive of the line of low-cost bench milling machines and accessories made by this company. 23

Midget Milling Cutters

SEVERANCE TOOL INDUSTRIES, INC., 636 Iowa Ave., Saginaw, Mich. Catalogue 16, describing the Severance line of midget milling cutters, including high-speed steel, cast-alloy, and cemented-carbide types. 24

Induction Heating Equipment

AJAX ELECTROTHERMIC CORPORATION, Ajax Park, Trenton 5, N. J. Bulletin 13-A, containing information on Ajax Northrup induction heating equipment and applications in forging, upsetting, spinning, and hardening. 25

Magnet Separating Device

ROCKFORD MAGNETIC PRODUCTS CO., INC., 1300 Eighteenth Ave., Rockford, Ill. Circular illustrating and describing the "Power-Grip" hand separator for separating steel pieces from non-magnetic materials. 26

Die-Sinking Machines

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 485, describing the construction and operation of Pratt & Whitney improved plain and universal die-sinkers, made in two sizes each. 27

Drafting-Room Instruments

HERMAN H. STICHT CO., INC., 27 Park Place, New York 7, N. Y. Leaflet descriptive of the "Minerva Curvimeter," a Swiss instrument for measuring the length of curves or other lines on a blueprint or plan. 28

Export Trade

ARMOR PRODUCTS, INC., 74 Trinity Place, New York 6, N. Y. Bulletin entitled "The Cross Roads of World Trade," describing the services offered by the company in handling promotion and sale of products for export. 29

Press Brakes

CYRIL BATH CO., 6955 Machinery Ave., Cleveland 8, Ohio. Catalogue S-1000, on Sturdybender universal press brakes, made in capacities of 60 to 120 tons. Details of construction and typical applications are shown. 30

Aluminum Brazing

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Pamphlet containing an article entitled "Torch Brazing Aluminum," covering all phases of the subject. 31

Magnetic Pulleys

ERIEZ MFG. CO., 2711 E. 12th St., Erie, Pa. Bulletin 501-A, describing the Eriez non-electric permanent-magnet pulley that automatically removes tramp metal from materials in process. 32

Electric Furnaces

SENTRY CO., Foxboro, Mass. Bulletin 1054, descriptive of Sentry electric furnaces and the Sentry diamond block method of atmospheric control for hardening high-speed steel. 33

Universal Tapping Machines

PROCUNIER SAFETY CHUCK CO., 18 S. Clinton St., Chicago 6, Ill. Circular A-47, illustrating and describing the company's new Series A universal tapping machines and the "Hi-Boy" lubricating pump. 34

Counting Devices

VEEDER-ROOT, INC., Hartford 2, Conn. General catalogue G-47, containing 109 pages of data on the complete line of counting devices made by the company for a variety of applications. 35

Nickeloid Fabrication Handbook

AMERICAN NICKELOID CO., Peru, Ill. Booklet entitled "N-M Fabrication Handbook," containing data on the fabricating of prefinished Nickeloid metals. 36

Die-Casting Facilities

ELECTRIC AUTO-LITE CO., Woodstock, Ill. Catalogue describing the die-casting activities of the company and its facilities for machining, finishing, and plating zinc or aluminum die-cast parts. 37

Taps

CHARLES L. JARVIS CO., DOWDING DIVISION, Middletown, Conn. Catalogue 101, containing specifications on Dowding "tailored" taps recently acquired by this company. 38

Electric Feedrail

FEEDRAIL CORPORATION, 125 Barclay St., New York 7, N. Y. Catalogue 20, describing applications of the electric feedrail for portable tools, cranes, machine tools, etc. 39

Projection Welders

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich. Bulletin 603, describing the company's complete new line of press type spot and projection welders...40

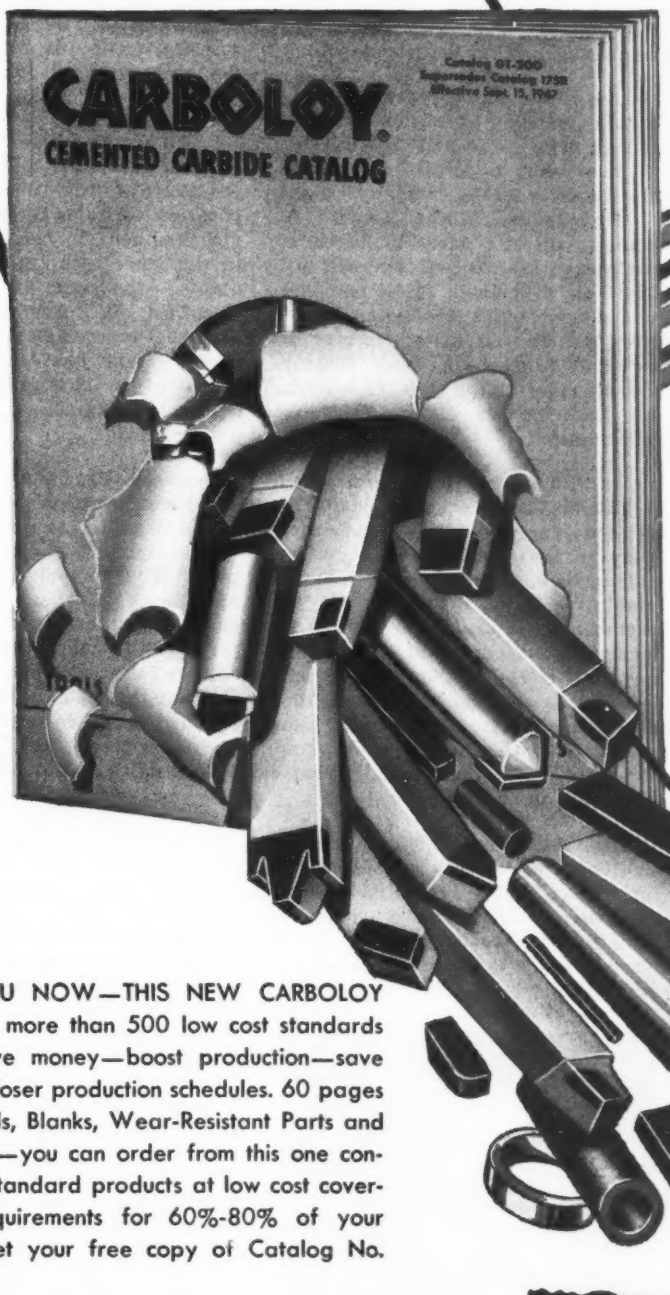
Cutting Oils

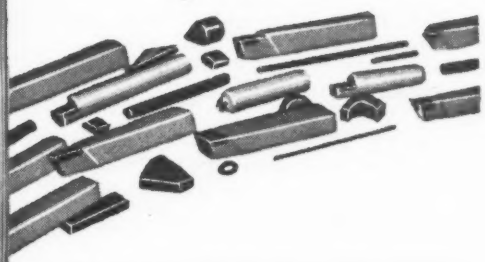
E. F. HOUGHTON & CO., Philadelphia 33, Pa. Folder announcing four new series of Houghton Cut-Max cutting oils. 41

Shaper Cutters

BOICE-CRANE CO., 959 W. Central Ave., Toledo 6, Ohio. Bulletin covering cutters for use on production type shapers. 42

It's Here! It's New! It's Yours





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News of the Industry

Georgia and Oklahoma

FRANK M. HIGGINS has recently been appointed manager of the Reeves Pulley Co.'s Atlanta, Ga., office, located at 990 Gordon St., S.W., Atlanta. Mr. Higgins has been associated with the design and installation of Reeves variable-speed equipment for fourteen years, the last three of which he has been acting as sales engineer, with headquarters at the home office of the company in Columbus, Ind.

MAX R. WISE, Tulsa, Okla., has been appointed sales agent for the BANNER IRON WORKS, St. Louis, Mo., manufacturer of Meehanite castings.

Illinois and Indiana

L. W. HAYDEN has been named resident vice-president in New York City, of the Lindberg Engineering Co., Chicago, Ill., and will have charge of all East Coast sales offices, as well as export sales. G. W. HELSBERG, formerly in New York, is now in charge of the Boston office, and R. W. DOUGHERTY, previously in charge of the Kalamazoo, Mich., office will head a new Lindberg office to be opened in Philadelphia. S. K. OLIVER, formerly at the New York office, will be moved to Cleveland, and T. M. LACRONE has been placed in charge of the Kalamazoo office.

ROGER G. DELONG has been appointed manager of the Hydraulic Division of the Twin Disc Clutch Co., Rockford, Ill., and W. B. GIBSON has been made sales manager of the division. Mr. DeLong has been serving as both acting manager and sales manager of the division, while Mr. Gibson previously held the post of assistant district manager of the eastern territory.

JAMES B. ELLIOTT, heretofore divisional manager for the Caldwell Division of the Link-Belt Co., Chicago, Ill., has been appointed divisional sales manager at the company's plant in Minneapolis, Minn. ERWIN A. WENDELL, district sales manager of the Chicago branch, will succeed Mr. Elliott as divisional sales manager for Caldwell plant products. T. W. MATCHETT, district sales engineer at New York, has been made district sales manager of the Chicago branch, with headquarters at the Pershing Road plant.

JOHN J. TAPPER, works manager of the Illinois Tool Works, Chicago, Ill., has been selected to attend the twelfth session of the Advanced Management Program being conducted at Harvard University from September 17 to December 13. The class is limited to seventy-five experienced managers, carefully chosen from applicants representing all phases of industry and business. Mr. Tapper has been associated with the Illinois Tool Works for more than twenty years, starting as an apprentice in 1926.

HYDRO-LINE MFG. CO., 711 Nineteenth St., Rockford, Ill., has appointed the HIRZEL SALES CO., 509 Curtis Building, Detroit, Mich., sales representative for the company's line of air and hydraulic cylinders and special machinery in Michigan and in bordering cities in Ohio and Canada. The company also announces the appointment of the HYDRAULIC STRAIGHTENING & MFG. CO., 1410 de la Torre Way, Los Angeles, Calif., as representative in the state of Arizona and part of California.

C. E. PALMER, former works manager of the Mechanics Universal Joint Division of the Borg-Warner Corporation, Chicago, Ill., has been named vice-president in charge of manufacturing for both of the division's plants — the one in operation at Rockford, Ill., and the one under construction at Memphis, Tenn. FRED M. POTGIETER has been elected vice-president in charge of truck, agricultural implement, industrial, and aviation sales.

BERNARD WELDING EQUIPMENT CO. has been organized at 741-43 E. 71st St., Chicago, Ill., to manufacture welding equipment of its own development. The company was started by ARTHUR A. BERNARD, who has had more than twenty-five years' experience in the development and application of welding processes, equipment, and accessories. The first product to be designed by the company is a new weld cleaning hammer known as the "Multi-Pic."

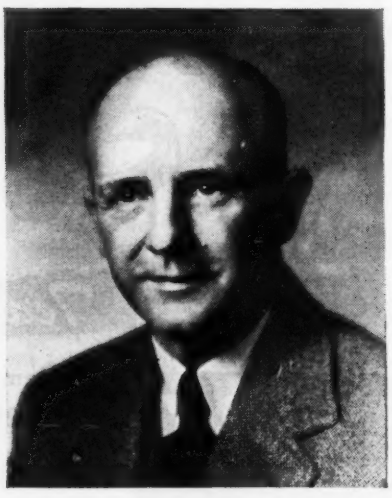
O. L. HOWLAND has been appointed sales manager of the Welding Division of the Metal & Thermit Corporation, with headquarters at 7300 S. Chicago Ave., Chicago, Ill. Mr. Howland became connected with the company in 1943 as district manager of the Chicago branch. WILLIAM C. CUNTZ will serve as assistant sales manager, with headquarters at 1514 W. North Ave., Pittsburgh, Pa.

ALBERT MUSSCHOOT, a member of the general engineering staff of the Link-Belt Co. at Philadelphia, Pa., has been appointed assistant to the chief engineer, with headquarters at the company's general office, 307 N. Michigan Ave., Chicago 1, Ill.

JACK & HEINTZ PRECISION INDUSTRIES, INC., Cleveland, Ohio, has appointed the AHLBERG BEARING CO., Chicago, Ill., representative for the Ball Bearing Division of the company.

E. W. DECK, until recently general manager of the Trent Tube Mfg. Co., has been appointed consultant on manufacturing research of the Borg-Warner Corporation, Chicago, Ill.

MCGILL MFG. CO., INC., manufacturer of precision bearings and electric



(Left) Roger G. De Long, Newly Appointed Manager of the Hydraulic Division of the Twin Disc Clutch Co. (Right) W. B. Gibson, New Sales Manager of the Division

GENERAL PROPERTIES AND USES FOR MOLDED PLASTICS MATERIALS—3

Type	Filler	Colors	Applications	Notch Impact Ft.-Lb. per In.	Flexural Strength Pounds per Sq. Inch	Tensile Strength Pounds per Sq. Inch	Water Absorption, Per Cent 48 Hours	Heat Resistance, Continuous Deg. F.	Dielectric Strength, Volts per Mil, Step-by-Step Test in Oil, ⅛-In. Specimen		Specific Gravity	Shrinkage Inch per Inch*	Bulk Factor†
									25° C.	100° C.			
Phenolic	Fabric—Medium Fiber	Black, Brown, Red	A high-impact material generally used for bulky sections. Thermosetting	3.00 to 3.50	10,000	6000 to 6500	1.0	248	200 to 250	50 to 80	1.38 to 1.42	0.003 to 0.004	8
Phenolic	Chopped Cord	Black	Highest-impact phenolic material. Cannot be used for some complex sections. Thermosetting	5.0	11,000	6200	1.0	248	300	70	1.35	0.003	8
Phenolic	Fabric and Graphite	Gun Metal	For cams, bearings, slides, etc., requiring high impact resistance and reduced friction. Thermosetting	0.70 to 0.80	8000 to 9000	6000	0.8 to 1.0	248	.....	.....	1.45	0.003 to 0.004	4
Phenolic	Cotton Flock and Graphite	Gun Metal	For cams, bearings, slides, etc., requiring medium impact resistance and reduced friction. Thermosetting	0.40	9500	6500	0.8 to 1.0	248	.....	.....	1.40	0.003 to 0.004	4
Phenolic	.....	.....	Used for the shielding of X-rays	0.30	9500	6000	0.5	248	.....	.....	.....	0.005 to 0.006	3
Phenolic-aniline	Wood Flour	Natural	Highest electrical properties with good arc resistance. Thermosetting	0.30	10,000	6000	1.25	248	300	300	1.34	0.006 to 0.008	3
Phenolic-aniline	Mineral	Natural	Radio or similar parts requiring low dielectric losses. Thermosetting	0.38	9500	6500	0.02	257	300 to 500	300 to 400	1.94	0.004	2.5
Phenolic-aniline	Cotton Flock	Natural	Highest electrical properties with improved impact resistance. Thermosetting	0.46	10,000	6500	1.20	248	300	200 to 300	1.34	0.006 to 0.008	4

*See Data Sheet No. 596.
†See Data Sheet No. 596.

MACHINERY'S Data Sheet No. 595, October, 1947

Compiled by the Shaw Insulator Co. Irvington, N. J.

GENERAL PROPERTIES AND USES FOR MOLDED PLASTICS MATERIALS—4

Type	Filler	Colors	Applications	Notch Impact Ft.-Lb. per In.	Flexural Strength Pounds per Sq. Inch	Tensile Strength Pounds per Sq. Inch	Water Absorption, Per Cent 48 Hours	Heat Resistance, Continuous Deg. F.	Dielectric Strength, Volts per Mil, Step-by-Step Test in Oil, ⅛-In. Specimen		Specific Gravity	Shrinkage Inch per Inch*	Bulk Factor†
									25° C.	100° C.			
Urea	Cellulose	All colors, including translucent and pastel shades	General-purpose color work. Has good arc resistance. Used for lamp shades, packages, radio cabinets, etc. Thermosetting	0.30	11,000	8000	2.00	170	300	80	1.49	0.008	3
Melamine	Cellulose	All colors, including translucent and pastel shades	General-purpose color work with improved temperature resistance. Good for dishes and buttons	0.28	12,000	6000	1.7	210	230	250	1.50	0.008	3
Melamine	Mineral and Cotton Flock	Gray	For electrical applications requiring improved arc resistance. Excellent for ignition parts. Thermosetting	0.44	8000	5000	0.25	284	300	200	1.80	0.006	2.5
Melamine	Fabric	Gray and Black	Combines good impact resistance with improved arc resistance. Thermosetting	0.90	10,000	7000	1.0	248	230	80	1.49	0.003 to 0.004	12
Cellulose-acetate	.....	All colors, transparent, translucent and opaque	General-purpose injection molding material. Uses limited by low softening point and moisture absorption. Thermoplastic	1.0 to 3.5	14,000	3000 to 8000	3.0	150	300	.....	1.30	0.002 to 0.010	3
Cellulose-acetate Butyrate	.....	All colors, transparent, translucent and opaque	General-purpose injection and extrusion material with better resistance to distortion under heat and humidity. Thermoplastic	1.0 to 4.0	12,000	3000 to 8000	2.0	150	200	.....	1.20	0.002 to 0.010	3

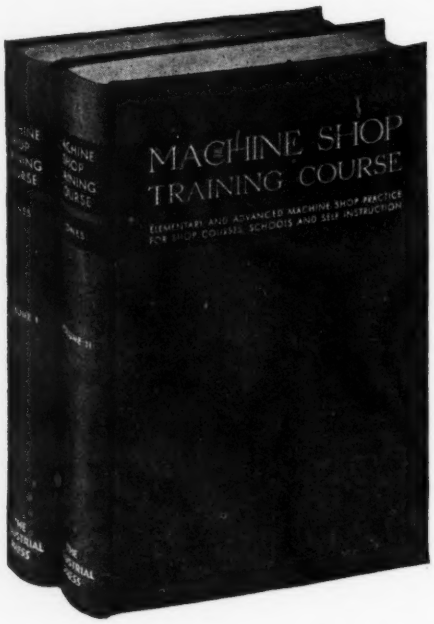
*Shrinkage values in table give amount of shrinkage in inches per inch of molding materials after they are molded under average conditions. Allowance must be made in the mold design to compensate for this shrinkage.
†Bulk factor is the ratio of the volume of compound before molding to the volume of the molded piece. Molds must be designed to allow sufficient space for loading the molding compound.

MACHINERY'S Data Sheet No. 596, October, 1947

Compiled by the Shaw Insulator Co. Irvington, N. J.

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

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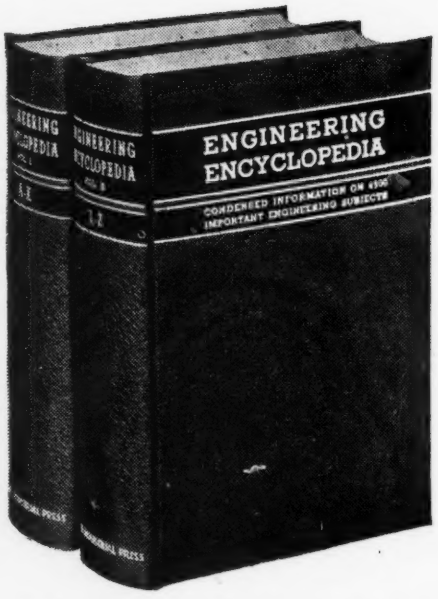

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THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

switches, has begun the construction of a $300,000 bearing division plant in Valparaiso, Ind. The new structure will be a two-story brick building, 120 by 270 feet, and will adjoin the present bearing division plant.

Michigan

PHILIP C. SATTERTHWAITE has been appointed vice-president in charge of manufacturing for the Cogsdill Twist Drill Co., Detroit 21, Mich. Mr. Satterthwaite has been associated with the company since 1932, having been engaged in designing special machinery for the manufacture of cutting tools. He has held the positions of chief engineer, director of purchases, and factory superintendent, from which latter position he was released to enter the armed services in October, 1940. On February 1, 1947, he returned to the company, and has been engaged in experimental development work until his present appointment.

E. W. BLISS CO., Detroit, Mich., announces that it has closed its Brooklyn factory as a final step in the reorganization of the company's facilities. Expansions of plant facilities are now under way at Toledo, Cleveland, and Salem, Ohio, and a new plant has been obtained in Englewood, N. J., which will be used for research and development in can-making machinery, as well as for supplying parts and services for Bliss presses installed in the East. The company also announces the removal of its New York metropolitan sales office and export office from Brooklyn to 19 E. 47th St., New York City.

LAPEER MFG. CO., Lapeer, Mich., has taken over KNU-VISE, INC., Detroit, Mich., and will continue to manufacture that company's line of toggle-action clamping devices. The sales office for Knu-Vise products will remain at 2208 Eighth St., Detroit.

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich., announces that it has recently been awarded the national and foreign sales rights for the new gear checker made by the Orlandi Gear & Machine Co., of Detroit, Mich.

CARBOLOY COMPANY, INC., Detroit, Mich., announces the appointment of the A. L. HOLCOMB CO., 15 Market Ave., N.W., Grand Rapids 2, Mich., as distributor for the company's products in northwestern Michigan.

B. A. JOHNSTON, who for some years served as sales manager of Hanson & Co., Detroit 11, Mich., manufacturer of precision gages, has rejoined the company in the capacity of sales engineer.

New England

JOSEPH P. CROSBY, vice-president and sales manager of the Lapointe Machine Tool Co., Hudson, Mass., manufacturer of broaching machines and broaches, and KENNETH N. MACOMBER, chief engineer of the company, are planning to leave New York in October for a two months' visit to Argentina and Brazil, with the purpose of making a lecture tour of various manufacturing plants and government arsenals in Buenos Aires and Rio de Janeiro. The subject of their talks will be new developments in surface broaching and the broaching of armament.

WILLIAM M. AUSTIN has been elected president and chairman of the board of the Austin-Hastings Co., Inc., Cambridge, Mass., distributor of machine tools and metal-working equipment, and ARTHUR B. KETTLE has been elected executive vice-president and general manager. LEON L. CLORE has been named manager of the Machinery Division of the company, and STUART L. HARROD succeeds Mr. Clore as western New England representative.

WILLIAM D. WARREN, who has been on MACHINERY's sales staff for many years—recently as subscription representative for the city of Boston and the states of Maine and New Hampshire—has retired from active service with the company. RICHARD D. HIBBARD, now in charge of subscription and book sales for New York State outside of Greater New York, as well as Connecticut, Western Massachusetts and Vermont, will take over Mr. Warren's territory.

MORTON J. RAINEY and ANTHONY J. SNYDER were elected vice-presidents of the Morse Twist Drill & Machine Co., New Bedford, Mass., at a recent meeting of the board of directors. Mr. Rainey is general sales manager of the company, and Mr. Snyder is works manager.

RICHARD L. WILCOX has been elected president of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., succeeding DAVID C. GRIGGS, who has become chairman of the board. Mr. Griggs has been connected with the company for fifty-four years in various capacities and served as president prior to his present appointment. Mr. Wilcox joined the company as a draftsman in 1898, advancing to the position of chief engineer of the Bolt and Screw Machinery Division. In 1920, he was elected a member of the board of directors, and became vice-president in 1928. He is succeeded as chief engineer by JOSEPH M. SCHAEFFER, assistant to Mr. Wilcox for many years.

WHITON MACHINE CO., New London, Conn., announces the appointment of the following distributors to handle Whiton chucks and gear-cutting and centering machines: ROBERT E. MORRIS CO., 967 Farmington Ave., West Hartford, Conn., and the LLOYD & ARMS CO., located at 3818 Chestnut Street, Philadelphia, Pa.

New Jersey

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., recently announced the following appointments in its equipment Sales Division: HARRY C. DISHMAN, equipment sales manager, with headquarters in Detroit; GEORGE T. YOUNG, branch manager of the Detroit office; E. E. JUERGENS, branch manager of the Cleveland office; and JOHN E. COLE, branch manager of the Chicago office.

Morton J. Rainey (Left) and Anthony J. Snyder (Right), Recently Elected Vice-presidents of the Morse Twist Drill & Machine Co.

B & M Mfg. Co., 19 N. Harrison St., East Orange, N. J., has recently been organized to manufacture spirally formed tubular products under the trade name of "Spiralock." The principals of the new company are Wiley W. McMinn and Olof Brant, formerly vice-president and chief development engineer, respectively, of the Agaloy Tubing Co.

J. K. Rector, formerly assistant advertising manager of the E. W. Bliss Co., Pittsburgh, Pa., has been appointed advertising and sales promotion manager of the Watson-Stillman Co., Roselle, N. J., manufacturer of hydraulic machinery and mill distributors' products.

New York

E. P. Gaffney, formerly manager of the machinery steel sales division of the Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y., has been appointed manager of the combined alloy and machinery steel sales division.

Gleason Works, Rochester, N. Y., has announced the following changes in its organization: James E. Gleason, president of the company since 1922, has become chairman of the board, and is succeeded as president by his son, E. Blakeney Gleason. Arthur L. Stewart has been designated vice-president, and will also retain the post of chief engineer. In addition to serving as president, E. Blakeney Gleason will continue to hold the offices of treasurer and general manager which he has occupied for a number of years. Lawrence C. Gleason was elected a director of the company at a recent meeting of the stockholders.

Joseph G. Magrath, Newly Appointed Executive Secretary of American Welding Society

Joseph Gordon Magrath has been selected by the board of directors of the American Welding Society, 33 W. 39th St., New York 18, N. Y., to fill the new position of executive secretary of the Society. Just before joining the staff of the American Welding Society, Mr. Magrath was sales manager of the McAlear Manufacturing Division of Climax Industries, Inc.

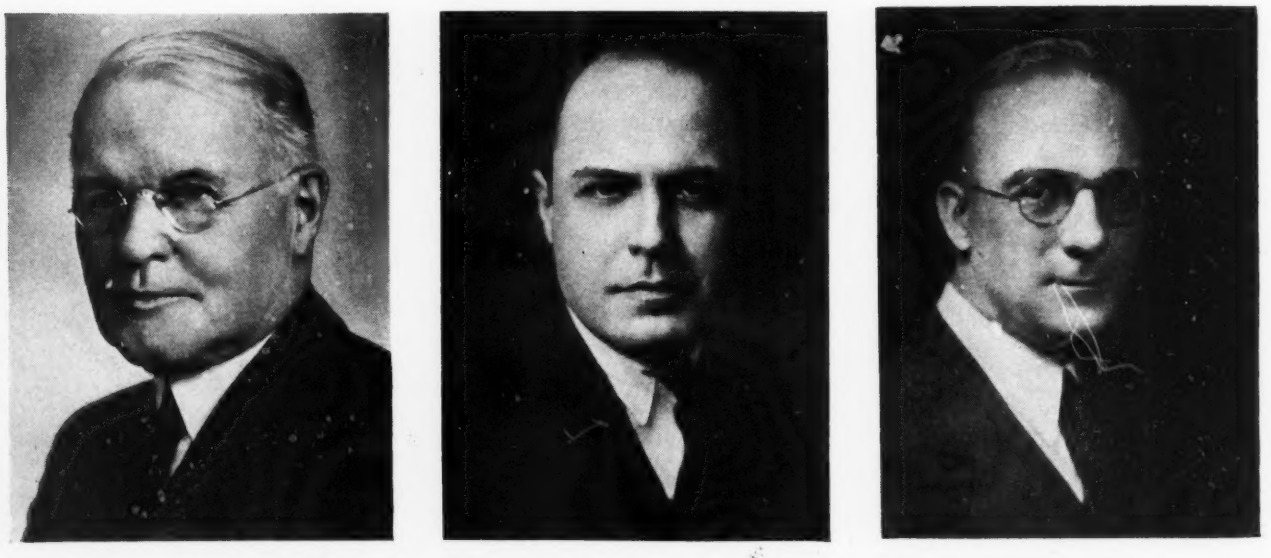
Carborundum Co., Niagara Falls, N. Y., has recently acquired through the War Assets Administration, the plant formerly operated by the Bell Aircraft Corporation in Niagara Falls. The newly acquired property comprises approximately sixty-five acres, and includes four buildings, making available a total floor area of 290,000 square feet. This property will be used primarily for the Coated Products Division of the concern. The company has also announced the acquisition of ninety-three acres of land in Vancouver, Wash., which will be used as a site for an extensive silicon-carbide furnace plant. It is proposed to spend upward of $2,000,000 on the plant, construction of which will be started within the near future.

Manzel Brothers Co., Buffalo, N. Y., manufacturer of lubrication equipment, has changed its name to Manzel, Inc. The company has just announced the completion of an extension expansion and modernization program, which doubles the floor space of the company's plant and increases the office area by 150 per cent.

Dr. Gurdon M. Butler, Jr., has been appointed a senior engineer of the Research Division of the Carborundum Co., Niagara Falls, N. Y. He was formerly associate director of research of the Tool and Die Steel Division and later chief metallurgist at the Dunkirk, N. Y., plant of the Allegheny Ludlum Steel Corporation.

Alfred Marchev has been elected president and general manager of the Aircraft Screw Products Co., Inc., Long Island City, N. Y., manufacturer of the Heli-coil and Aero-Thread screw thread systems. Mr. Marchev was previously president and chairman of the board of the Republic Aviation Corporation.

Cleveland Tapping Machine Co., Hartville, Ohio, manufacturer of Cleveland lead-screw tapping machines, has appointed the Meehan Engineering Co., 1802 W. Genesee St., Syracuse 4, N. Y., sales representative of the company for New York state north of Sullivan, Ulster, and Dutchess Counties.



(Left to Right) James E. Gleason, Chairman of the Board, Gleason Works; E. Blakeney Gleason, Newly Elected President; and Arthur L. Stewart, Vice-president and Chief Engineer

HOW MUCH COST CAN A SAW BLADE CUT?

Plenty—if it's made of molybdenum high-speed steel. Most of the major hacksaw blade manufacturers have standardized on molybdenum steels.

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CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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MOLY

DAVID K. MILLER, formerly manager of the Baltimore branch of the Crucible Steel Co. of America, New York 17, N. Y., has recently been appointed a special representative to the branches in the promotion of alloy and machinery steels. He has had over twenty years of experience with the company.

SINTERCAST CORPORATION OF AMERICA has been organized in New York City to engage in consultation, research, and development in the field of powder metallurgy. ERWIN LOEWY,

Erwin Loewy, President of the Sintercast Corporation of America

president of Hydropress, Inc., is president of the new company. DR. CLAUS G. GOETZEL is vice-president and director of research, and JOHN ELLIS is chief engineer.

DR. FLOYD J. METZGER, vice-president in charge of liquefaction research for the Air Reduction Co., 60 E. 42nd St., New York 17, N. Y., has resigned and will be succeeded as director of liquefaction research by MORROUGH P. O'BRIEN, former dean of engineering of the University of California.

DOUGLAS M. MCBEAN, INC., consulting engineers of Rochester, N. Y., announce that an office has been opened at 61 W. 56th St., New York 19, N. Y.

Ohio and Kentucky

VANCE R. PARKER has been appointed sales engineer in the Dayton, Ohio, area for the E. W. Bliss Co., Detroit, Mich., builder of mechanical and hydraulic presses, container making machinery, and rolling mill equipment. His headquarters will be at 610 Broad Blvd., Dayton. Mr. Parker has been associated with the company for the last twelve years. Prior to his present appointment, he was sales engineer in the New York City area.

L. L. WARRINER, president of the Master Electric Co., Dayton, Ohio, has been elected a director of the Monarch Machine Tool Co., Sidney, Ohio.

GEORGE E. HALLENBECK, president since 1939 of Baker Brothers, Inc., Toledo, Ohio, manufacturers of drilling, boring, and tapping machines, has been advanced to chairman of the board. A. L. BAKER, vice-president and general manager, has been elected president and general manager, and HERBERT L. TIGGES, vice-president in charge of sales, has been elected executive vice-president. M. E. FISCHER, superintendent, has been made vice-president in charge of manufacturing. THOMAS L. HALLENBECK, research engineer for the company, has become vice-president and director of engineering.

Richard Y. Moss, Recently Appointed Sales Manager of Sheffield Corporation

RICHARD Y. MOSS has been appointed sales manager of the Machine Tool Division of the Sheffield Corporation, Dayton 1, Ohio. He will also have charge of the sales of the "Measuray," an X-ray gage for non-contact measurement in the continuous production of steel, copper, brass, aluminum, plastics, etc. J. T. WELSH will serve as his assistant.

CHARLES G. HERBRUCK has been appointed assistant secretary of the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. For the last five years, Mr. Herbruck has been engaged in plant supervision in the welding industry, and in planning and developing welded designs.

HARRY Y. MCCOOL, SR., superintendent of maintenance of the Steel and Tube Division of the Timken Roller

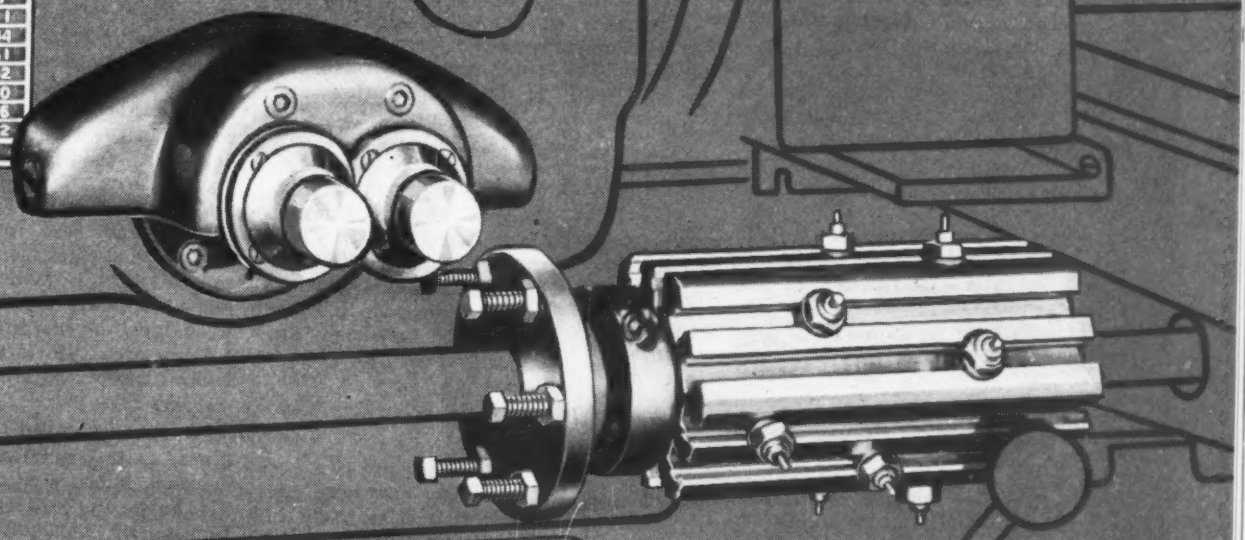
(Left to Right) George E. Hallenbeck, Newly Elected Chairman of the Board, Baker Brothers; A. L. Baker, President and General Manager; and Herbert L. Tigges, Executive Vice-president

GISHOLT FASTERMATICS

(AUTOMATIC TURRET LATHES)

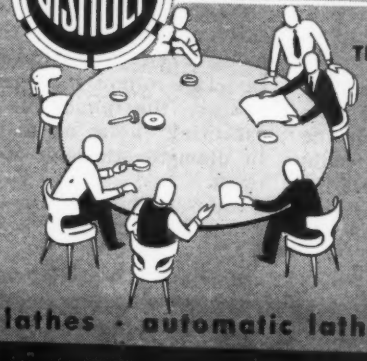
GEARS TEETH LOWER	SPINDLE SPEEDS VALVE DIAL POSITIONS NO.183	NO.184	NO.283
65	22	40	74
61	27	50	91
57	33	61	111
53	40	73	134
49	48	87	161
45	57	105	192
41	68	125	230
37	81	150	276
33	96	181	332

DRIVE SHAFT SPEED 1040 R.P.M.



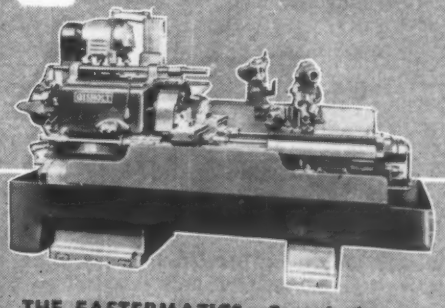
These simple controls provide automatic (or manual) selection of speeds--to save time --cut machining costs

GISHOLT MACHINE COMPANY, *Madison 3, Wisconsin*



THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.



THE FASTERMATICS—Speed changes are effected as buttons in spool contact hydraulic control knobs. Changes may be made automatically at any point during hexagon turret's travel, or manually for convenience of set-up. Various ranges of spindle speeds are available.

turret lathes · automatic lathes · superfinishers · balancers · special machines

Bearing Co., Canton, Ohio, retired on September 1 after more than thirty-one years of service with the company. LELAND S. STEINER has been named successor to Mr. McCool. He was previously assistant superintendent of maintenance.

A. F. BOUCHER, welding engineer for the Lincoln Electric Co., Cleveland, Ohio, in the Detroit area, has been made district manager for the Milwaukee office at 733 N. Van Buren St., Milwaukee, Wis. MARSHALL FORD has been made district manager for the Minneapolis office at 529 S. Seventh St., Minneapolis, Minn.

W. S. O'CONNOR has been appointed sales manager of the Standard Tool Co., Cleveland, Ohio. He was previously general sales manager of the U. S. Gage Division of American Machine & Metals, Inc.

U. S. DRILL HEAD Co., Cincinnati, Ohio, announces that it has sold its associate company, the U. S. MACHINE TOOL Co., manufacturer of anti-friction bearings and hand feed milling machines, to the N. RANSCHOFF Co., of Cincinnati.

EARLE E. WADE has recently been appointed sales engineer of the T. R. Wigglesworth Machinery Co., Cleveland, Ohio. He was previously chief engineer for the Eberhard Mfg. Co., of Cleveland.

UNITED ALUMINUM CASTINGS Co. has extended its facilities by moving into a new plant at 3471 W. 140th St., Cleveland 11, Ohio.

HARRY E. WEILER has been made manager of the Louisville district sales office of Reynolds Metals Co., with headquarters at 2500 S. Third St., Louisville, Ky.

Pennsylvania and Maryland

W. B. PEIRCE, for fifteen years vice-president in charge of research and development for the Flannery Bolt Co., Bridgeville, Pa., has resigned that position in order to devote more time to his duties as president of the American Society of Tool Engineers. In the future, he will be connected with the G. C. Wood Co., 613 Clark Bldg., Pittsburgh, Pa., manufacturers' representative.

HENRY DISSTON & SONS, INC., Philadelphia, Pa., has appointed STEEL DISTRIBUTORS, INC., Tioga and Salmon Sts., Philadelphia, distributors of the complete line of Disston tool steels in the Philadelphia area.

JOHNSON BRONZE Co., New Castle, Pa., has opened new sales offices and warehouses at 1513 Guilford Ave., Baltimore, Md., and at 1044-46 Broadway, Denver, Colo.

PANGBORN CORPORATION, Hagerstown, Md., manufacturer of blast cleaning and dust control equipment, announces the following changes in personnel: RALPH M. TRENT, for fourteen years manager of the Pittsburgh and Central Pennsylvania district, has been transferred to the Pacific Coast as manager of all Pangborn business on the West Coast, with headquarters in Los Angeles, Calif. JOHN D. WISE, former director of Purchases of the corporation and district sales representative in Chicago since 1945, will succeed Mr. Trent as manager of the Pittsburgh district, 200 Magee Bldg., 334 Fourth Ave., Pittsburgh. FRANK NEWELL, who has been engaged for six years in field work throughout the Middle West, will be transferred to Chicago as district sales engineer, with headquarters at 510 N. Dearborn St., Chicago.

Wisconsin

WADE A. ESKRIDGE has been appointed assistant district manager in the mid-continent territory for the Twin Disc Clutch Co. of Racine, Wis., and will have charge of operations in the Tulsa, Okla., office. H. A. DAVIS, manager of the mid-continent territory, has changed his headquarters from Tulsa to Dallas, Tex.

FRED F. LOOCK, formerly vice-president and general manager of the Allen-Bradley Co., Milwaukee, Wis., manufacturer of electric control apparatus, has been elected president of the company. HARRY L. BRADLEY has been named chairman of the board.

Canada

H. M. GRIFFITH, until recently general superintendent of the Hamilton and Ontario Works of the Steel Co. of Canada, Ltd., Montreal, Canada, has been made works manager of those plants. GEORGE P. MCALEER, formerly assistant general superintendent, becomes assistant works manager.

ARCHIBALD H. BALLARD has been appointed assistant director of research for the Norton Co., Worcester, Mass. He will have charge of the company's research laboratories at Chippawa, Ontario, Canada, where he succeeds RAYMOND R. RIDGWAY, who died last June.

* * *

If a man held an electron and an orange under a microscope and magnified them until the orange was the size of the world, the electron would still be invisible.—*Science Digest*

Obituaries

GEORGE W. DEWEES, for thirty-four years a member of the factory, engineering, and sales staffs of S K F Industries, Inc., died on August 19 of a heart attack at his home in Clearwater, Fla., aged sixty-seven years. Mr. Dewees was Florida sales and service engineer for S K F at the time of his death, and was widely known in the ball and roller bearing field. He joined the Hess-Bright Mfg. Co., which was later merged with the S K F organization, in 1913 as a grinder and rose to general plant foreman and chief inspector of quality control. Born in Montgomery County, Pa., on January 16, 1880 Mr. Dewees lived most of his life in the Philadelphia area. He is survived by his widow, a son, and a daughter.

OSCAR C. BORNHOLT, industrial engineer with the Hancock Mfg. Co., Jackson, Mich., died on August 26 at his home in Jackson after a long illness. Mr. Bornholt was associated with the late Harold Wills, of the Ford Motor Co., during the peak production years of the Model T car. He was engaged in special engineering work with Walter Chrysler during World War I, and later became vice-president of the Oakes Products Co., Indianapolis, Ind., and general manager of the Oakes Division of the Houdaille-Hershey Corporation, Waukegan, Ill.

MAURICE HOOFF, general production manager of the Hyster Co., Portland, Ore., manufacturer of tractor equipment and industrial trucks, died on August 22 in Portland at the age of forty-seven years. Mr. Hooff, who was born in Holland, had been connected with the company since its first day of operation. He had been in charge of production for the three Hyster factories—at Portland, and at Peoria and Danville, Ill.—for several years, and under his direction, production figures reached high totals. He is survived by his widow and two sons.

* * *

"Shooting" Holes in Steel Rails

Ford Motor Co. railroad workers are now equipped with a "cannon" that will shoot holes in steel rails. This 45-pound, portable industrial fire-arm, known as a "velocity power-rail punch," eliminates the drilling of holes when laying track. Firing a cartridge slightly larger than 0.45 caliber, the punch is capable of "shooting" holes up to 1 1/2 inches in diameter through steel 3/4 inch thick.

Arbor Press of Welded Design Is Stronger, Lighter, More Economical

By K. A. Ruger, President
Ruger Equipment Co., Inc., Cleveland 14, Ohio

FOLLOWING the modern trend in machine design, the new Ruger 10-ton portable hydraulic arbor press was designed for arc welded steel construction for two reasons: (1) because we have found arc welding is generally the most economical fabricating process; (2) to achieve the greatest strength from the least weight. The Ruger press can easily be moved from place to place by one man as the total weight is only about 100 lbs.

Fig. 1 shows the component parts. The plates are SAE 1020 mild steel, cut out on a flame-cutting machine guided by templates. The two side plates are braked to a 1⅛″ offset so they are closer together at the top. The base angles are formed from ⅜″ flat plate on a brake and the corners rounded on the flame-cutter. The cylinder cover is seamless steel tubing bored out to take the hydraulic cylinder.

The sides, angles, spacer plate and cylinder cover are assembled in a jig and tack-welded together. Nearly all welding is done in this jig, which is tilted to various positions for 100% downhand welding. Fig. 2 shows the cylinder cover being welded to the side plates.

Maximum welding speed is obtained by using Lincoln "Fleetwelding" technique—single pass, deep penetration welds in downhand position. "Fleetweld 11" electrode is used because of its speed, penetration and smooth concave bead which requires little finishing.

The side plates are welded to the base angles with the jig at a 45° angle (Fig. 3) to make single-pass fillets. The spacer plate is welded to sides with 1″ intermittent welds and the ends of the base angles are butt-welded to the sides. The press is

Fig. 2. Welding cylinder cover to the side plates.

then removed from the jig, turned upside down and the angles joined to bottoms of the side plates with deep groove butt welds.

The cylinder welds are then ground down flush with the sides, and the other welds cleaned with a grinder. The hydraulic pump assembly is installed and a 16-gauge sheet metal cylinder cap is welded on with "Fleetweld 7," which makes a convex bead for a neat, rounded appearance. Then the unit is painted and crated.

Fig. 4 shows the completed press. Its overall dimensions are: 23½″ high, 11¼″ wide and 20″ long from front to back. The throat height is 11″ and ram stroke is 6⅝″. Ram automatically retracts to top position by a built-in counter balance.

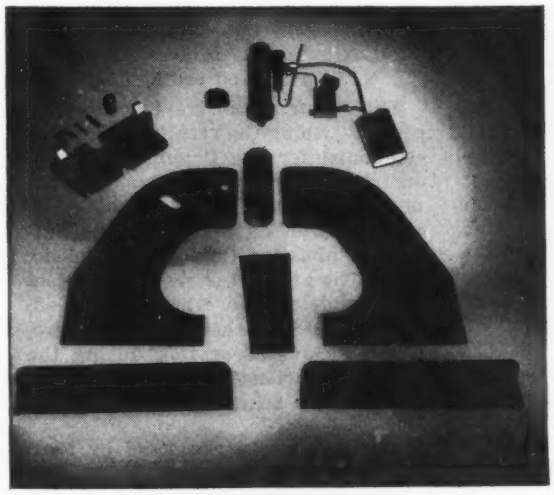


Fig. 1. Component parts of the Ruger Press.

Fig. 3. Welding base angles to side plates.

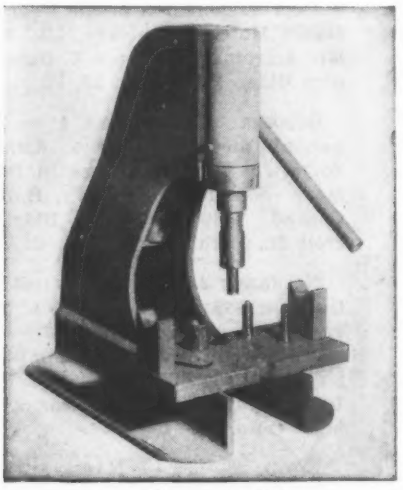


Fig. 4. The completed press.

The above is published by LINCOLN ELECTRIC in the interests of progress.
For Studies in Machine Design, write The Lincoln Electric Company, Dept. 229, Cleveland 1, Ohio.

Coming Events

OCTOBER 16-17—Third annual meeting of the NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS at the Hotel Continental in Chicago, Ill. Chairman of the publications committee, S. Charles Pappageorge, 35 W. 33rd St., Chicago 16, Ill.

OCTOBER 18-24—Twenty-ninth annual NATIONAL METAL CONGRESS AND EXPOSITION at the International Amphitheater, Chicago, Ill., sponsored by the American Society for Metals. W. H. Eisenman, national secretary of the American Society for Metals and managing director of the exposition, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 20-24—Annual meeting of the AMERICAN SOCIETY FOR METALS at the Palmer House, Chicago, Ill. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 20-24—Annual meeting of the AMERICAN WELDING SOCIETY at the Hotel Sherman, Chicago, Ill. Secretary, M. M. Kelly, 33 W. 39th St., New York 18, N. Y.

OCTOBER 20-24—Annual meeting of the AMERICAN INDUSTRIAL RADIUM & X-RAY SOCIETY at the Continental Hotel, Chicago, Ill. Secretary, Philip D. Johnson, 53 W. Jackson Blvd., Chicago 4, Ill.

OCTOBER 23-25—INDUSTRIAL MANAGEMENT CONFERENCE at the University of Missouri, Columbia, Mo. Further information can be obtained from Robert P. Alberts, executive secretary and publicity chairman of the conference, University of Missouri, Columbia, Mo.

OCTOBER 27-29—Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel in Chicago, Ill. Executive secretary, Newbold C. Goin, Empire Bldg., Pittsburgh 22, Pa.

OCTOBER 30 - NOVEMBER 1 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Boston, Mass. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

NOVEMBER 2-5 — Annual meeting of the NATIONAL TOOL AND DIE MANUFACTURERS ASSOCIATION at the Benjamin Franklin Hotel, Philadelphia, Pa. Executive secretary, George S. Eaton, 1412 Union Commerce Bldg., Cleveland, Ohio.

NOVEMBER 3-5 — NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel, Chicago, Ill. Further information can be obtained from H. S. Renne, 185 N. Wabash Ave., Chicago 1, Ill.

NOVEMBER 6-7—Fuels and lubricants meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS, at the Hotel Mayo, Tulsa, Okla. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-3—Air Transport meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Continental, Kansas City, Mo. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall, Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

DECEMBER 1-6—Twenty-first CHEMICAL INDUSTRIES EXPOSITION at the Grand Central Palace in New York City. For further information, address International Exposition Co., Grand Central Palace, New York 17, N. Y.

DECEMBER 4-6—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel Pennsylvania, New York City. Further information can be obtained from the Society, P. O. Box 168, Cambridge 39, Mass.

JANUARY 12-16, 1948—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 15-21, 1948 — Sixteenth annual meeting and Tool Exhibition of the AMERICAN SOCIETY OF TOOL ENGINEERS in Cleveland, Ohio. Harry E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

MARCH 18-19, 1948—Fourth annual meeting and exhibit of the MAGNESIUM ASSOCIATION at the Pennsylvania Hotel, New York City. Further information can be obtained from the Association, 30 Rockefeller Plaza, New York 20, N. Y.

New Books and Publications

COMPRESSED AIR HANDBOOK. 400 pages, 6 by 9 inches. Published by the Compressed Air and Gas Institute, New York, N. Y. Price $3.

This book comprises reference text on applications, installation, operation, and maintenance of compressing equipment and air-powered tools of all types. It also contains all of the standard reference material formerly published as "Trade Standards." Included are definitions, test standards, and numerous basic tables and formulas.

The data presented in the handbook represents the collective knowledge and experience of the nineteen member companies of the Compressed Air and Gas Institute, and was compiled over a two-year period as a joint activity of the Institute's Educational and Technical Committees. The book contains chapters on typical applications of compressed air and gas; representative types of compressor installations; portable air-operated tools and rock drills; engineering the compressor installation for maximum efficiency; and compressed-air engineering data and test procedure.

PERSONNEL MANUAL FOR EXECUTIVES. By Ross Young. 207 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $2.50.

Presenting a new approach to books on supervision, this manual is directed to everyone who has charge of people, whether a few or a large number. The aim is to provide an enlightening and practical treatment of the daily problems of supervision, considered from the psychological viewpoint. Attention is called particularly to such considerations as motivation and selling ideas, improved methods, use of sound business principles, facing economic realities, relationship of supervision to profits, and the value of mental and physical health. The supervisory methods outlined are based on experience and research.

RESEARCH IN CONTROLLED VACUUM HEAT-TREATING. 19 pages, 8 1/2 by 11 inches. Published by the American Gas Association, 420 Lexington Ave., New York 17, N. Y. Price, 50 cents.

This is an extensive technical report describing the results of research conducted for the Committee on Industrial and Commercial Gas Research of the American Gas Association by the Research Laboratory of the Surface Combustion Corporation, Toledo, Ohio. The aim of the research project was to determine what effects—advantageous or otherwise—were produced by gas absorption during the usual operations to which steel is subjected in heat-treatment.

STRESS CORROSION CRACKING OF MILD STEEL. By James T. Waber and Hugh J. McDonald. 94 pages, 5¾ by 8¾ inches. Published by the Corrosion Publishing Co., 1131 Wolfendale St., Pittsburgh 12, Pa. Price, $2.

Design, Construction, Operation of Metal-Working Equipment and Manufacture of Metal Products

MACHINERY

VOLUME 54 NOVEMBER, 1947 NUMBER 3

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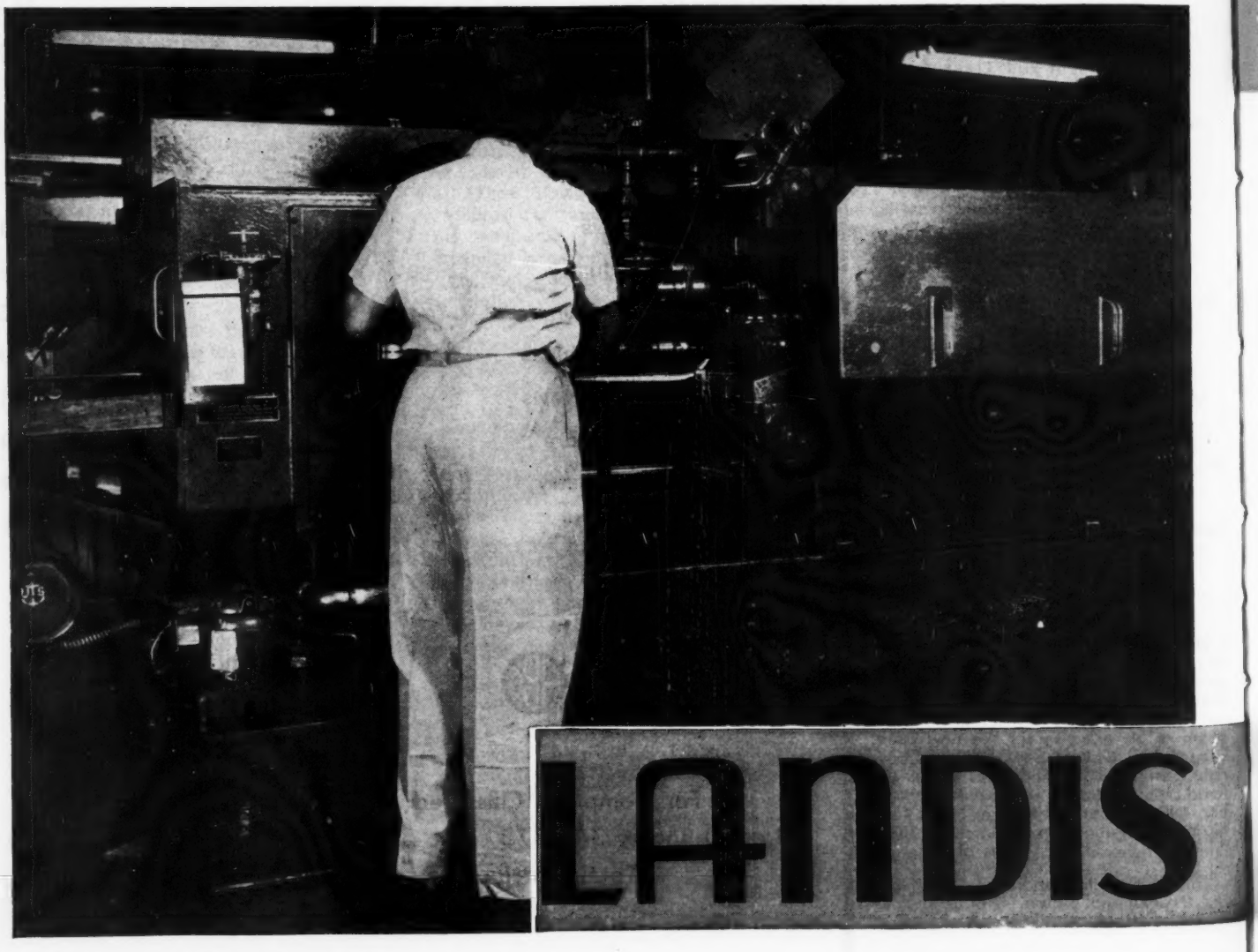
Total Distribution for October, 22,907

LANDEX DIE HEADS ... *designed for FINE ACCURACY on "live" spindle machines*

The Landex Hardened and Ground Die Head is designed for threading work where fine accuracy and maximum production are of prime importance. Developed for use on automatic screw machines, it is equally adaptable to drill presses and other machines having either a vertical or horizontal "live spindle."

The Landex Hardened and Ground Die Head is opened and closed automatically through a yoke attached to the machine. It has many distinctive features, such as: unusual flexibility in permitting quick set-up changes, wide range coverage, oversize capacity, low operating cost.

The Landex Hardened and Ground Die Heads employ the patented Landis Chaser which operates at a tangent to the work and which, for this reason, has the free cutting action and natural clearance of a lathe tool. This distinctive design results in long service between grinds and smooth finish and accuracy in the finished threads.

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